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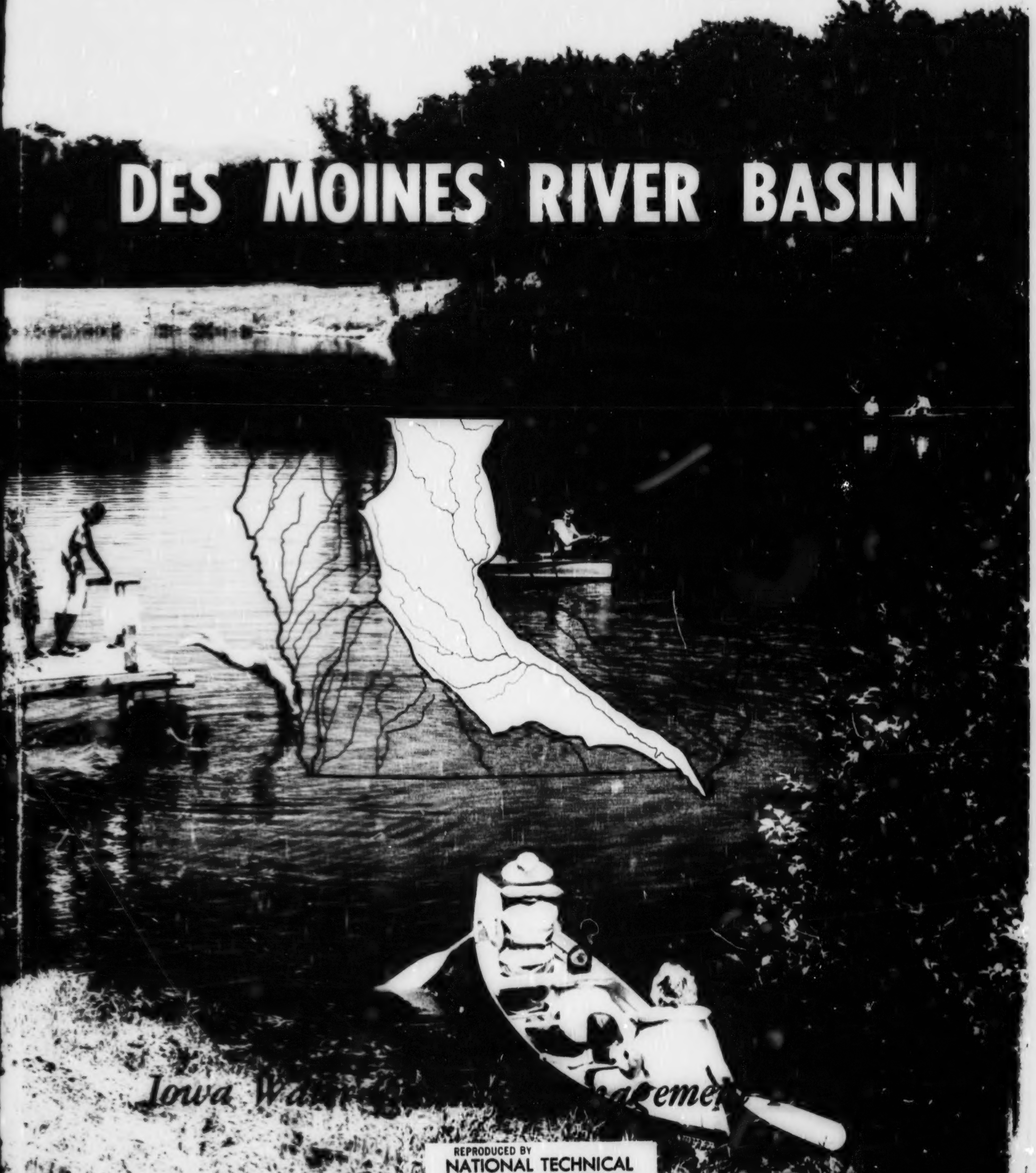
Iowa Water Quality Management Plan Des Moines River Basin

Iowa Dept of Environmental Quality, Des Moines

Jul 76

PB 264 679

DES MOINES RIVER BASIN



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16. ABSTRACT

This basin plan is for one of six major river basins partially located in Iowa. These plans fulfill Phase I requirements of Section 303(e) of Public Law 92-500, the Federal Water Pollution Control Act Amendments of 1972. It includes a determination of existing water quality, applicable water quality standards, and significant point and nonpoint sources of pollution within the basin. Point source pollution abatement is the main emphasis of the plan. The plan contains effluent limits for point source wastewater discharges, compliance schedules to meet these limits, a priority ranking of municipal discharges for use in determining the distribution of Federal and State grant funds used in the construction and/or upgrading of municipal wastewater treatment plants, and a table of municipal and industrial wastewater treatment needs.

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WATER QUALITY MANAGEMENT PLAN

DES MOINES RIVER BASIN

July, 1976

The Iowa Water Quality Commission approval of these plans is limited to the criteria and strategies described in the plans. Specific effluent limits, compliance schedules and discharger rankings must be considered tentative. New information, growth patterns, industrial development, grant funds and numerous other factors will require that the operation permits issued to each discharger reflect the most current information available and therefore they may vary from the values and the dates contained in the plans.

PLANNING AND ANALYSIS SECTION
WATER QUALITY MANAGEMENT DIVISION
IOWA DEPARTMENT OF ENVIRONMENTAL QUALITY

ACKNOWLEDGMENT

We gratefully acknowledge the assistance of the many State and Federal agencies and individuals that have provided data, reviewed drafts, and helped in other ways during the formulation and preparation of this water quality management plan. We also acknowledge the work of Stanley Consultants, Inc. in the development of the preliminary waste load allocation studies used in this plan.

FOREWORD

Under section 455B.31, Code of Iowa, 1973, the Iowa Department of Environmental Quality (DEQ) is charged with the responsibility of protecting and maintaining surface and ground water quality throughout the State. To assist the Department in this task, this basin plan has been prepared to coordinate and direct the State's water quality management decisions on a river basin scale.

The national goal, established in the Federal Water Pollution Control Act Amendments of 1972, (the Act), provides for water quality suitable for the protection and propagation of fish and wildlife, as well as for recreational activities in all surface waters by July 1, 1983. The Amendments define basin planning (Section 303(e)) as a key element for the determination and implementation of the necessary requirements to achieve national water quality goals.

Six major river basins, as defined by the Department of Environmental Quality, are partially located in the State of Iowa. Basin boundary lines are drawn to separate hydrological drainage areas (Figure 1). Any minor deviation from this is done only to be consistent with the boundaries of the six Iowa Conservancy Districts, as established by Chapter 467D.3 of the Code of Iowa. This provides the most compatible use of data among different State agencies.

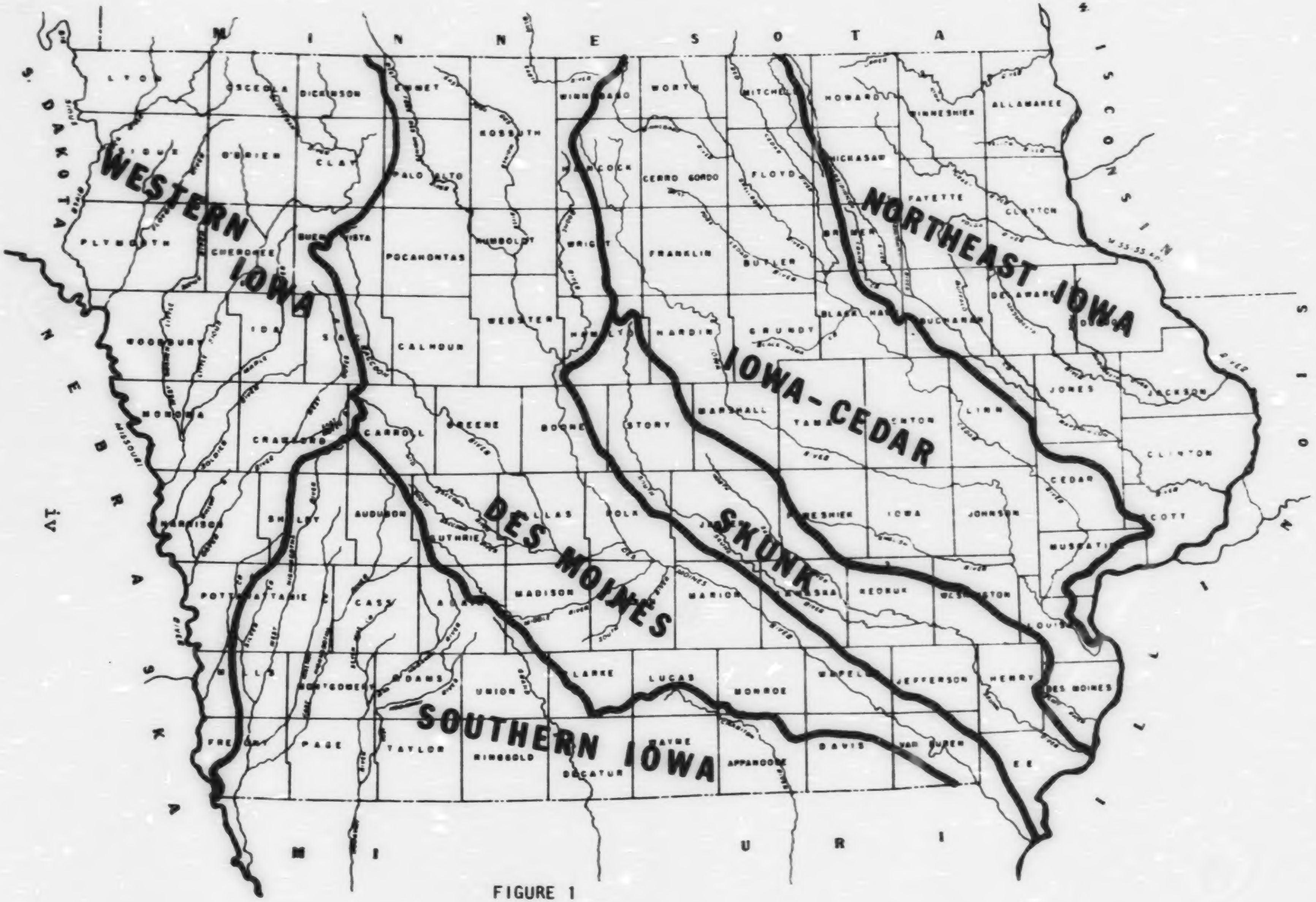

MINNESOTA
WISCONSIN
ILLINOIS
MISSOURI
NEBRASKA
S. DAKOTA
WESTERN IOWA
NORTHEAST IOWA
IOWA-CEDAR
SKUNK
DES MOINES
SOUTHERN IOWA
LYON
OSCEOLA
DICKINSON
EMMET
KOSSUTH
WINNEBAGO
WORTH
MITCHELL
HOWARD
WINNESHIEK
ALLAMAKEE
O'BRIEN
CLAY
PALO ALTO
HANCOCK
CERRO GORDO
FLOYD
CHICKASAW
FAYETTE
CLAYTON
PLYMOUTH
CHEROKEE
BUENA VISTA
POCAHONTAS
HUMBOLDT
WRIGHT
FRANKLIN
BUTLER
BREMER
DELAWARE
DUBUQUE
WOODBURY
IDA
SAC
CALHOUN
WEBSTER
HAMILTON
HARDIN
GRUNDY
BLACK HAWK
BUCHANAN
JONES
JACKSON
MONONA
CRAWFORD
CARROLL
GREENE
BOONE
STORY
MARSHALL
TAMA
BENTON
LINN
CLINTON
CEDAR
SCOTT
HARRISON
SHELBY
AUDUBON
GUTHRIE
DALLAS
POLK
JASPER
POWESHIEK
IOWA
JOHNSON
MUSCATINE
POTTAWATTAMIE
CASS
ADAIR
MADISON
MARION
MAHASKA
KEOKUK
WASHINGTON
LOUISA
MILLS
MONTGOMERY
ADAMS
UNION
CLARKE
LUCAS
MONROE
WAPELLO
JEFFERSON
HENRY
DES MOINES
FREMONT
PAGE
TAYLOR
RINGGOLD
DECATUR
WAYNE
APPANOOSE
DAVIS
VAN BUREN
LEE
MISSOURI
RIVER

FIGURE 1

IOWA RIVER BASINS

This basin plan is one of a series for the six major river basins in Iowa. These plans are supplemented by the Supporting Document for Iowa Water Quality Management Plans which contains general information of a supporting or background nature applicable to all six basins. The planning documents will be prepared by the Water Quality Management Division of DEQ. The planning information contained herein is part of a continuing planning process. Changes will occur since this plan describes a dynamic process. Basin plans will be reviewed at least every five years with interim revisions as significant changes occur.

This plan includes a determination of existing water quality, applicable standards, and significant point and nonpoint sources of pollution in the Des Moines River Basin. The plan then identifies and sets forth measures to correct the basin's water quality problems. Authority for this basin plan is derived from Section 455B.32, of the Code of Iowa.

This basin plan is specifically directed towards satisfying requirements of section 303(e) of the Federal Water Pollution Control Act, as amended; Public Law 92-500, 86 Statute 816 (1972); (33 United States Congress 1251 et sequens). The plan will serve local and regional governments as well as State and Federal agencies.

SCOPE

This basin plan addresses the Des Moines River Basin in Iowa from the Minnesota-Iowa State line to the confluence of the Des Moines River with the Mississippi River at Keokuk, Iowa. The Des Moines River Basin is composed of three major subbasins: The Upper Des Moines River Subbasin (Figure 2), the Raccoon River Subbasin (Figure 3), and the Lower Des Moines River Subbasin (Figure 4). Because it is a part of the same conservancy district, a small portion of the Blue Earth basin is also defined to be in the Des Moines basin (Figure 2).

The scope of this plan entails the study of the following items: (1) Water Quality Management Programs, (2) Existing Development Patterns and Basin Characteristics, (3) Existing Water Quality, (4) Inventories of all Point Sources of Wastewater Discharge, (5) Assessment of Nonpoint Pollution Sources, (6) Stream Segment Analyses and Waste Load Allocations, and (7) Assessment of Needs and Compliance Schedules. The detail of study of this document is as follows:

Chapter

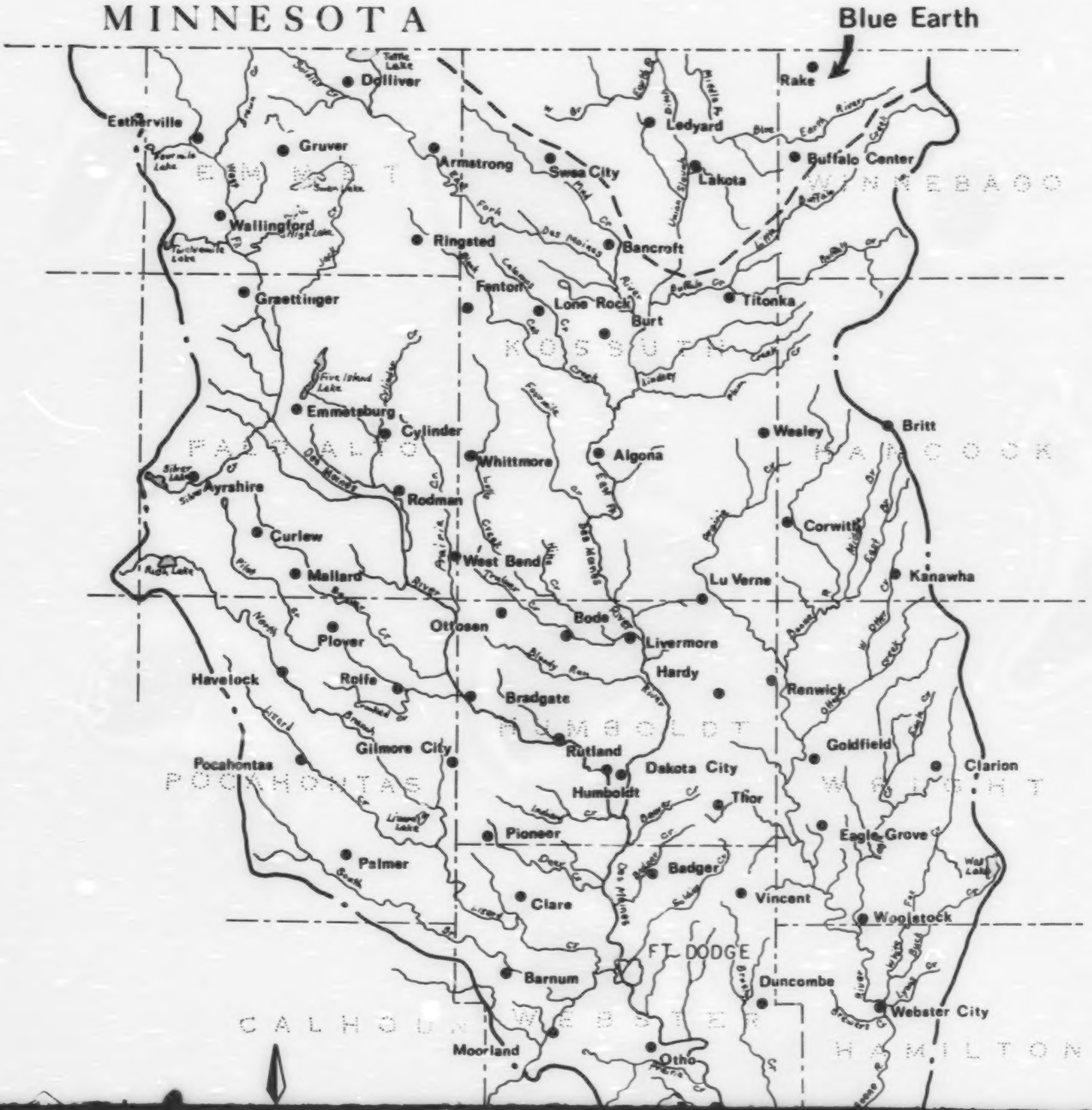
I. Iowa's Water Quality Management Program

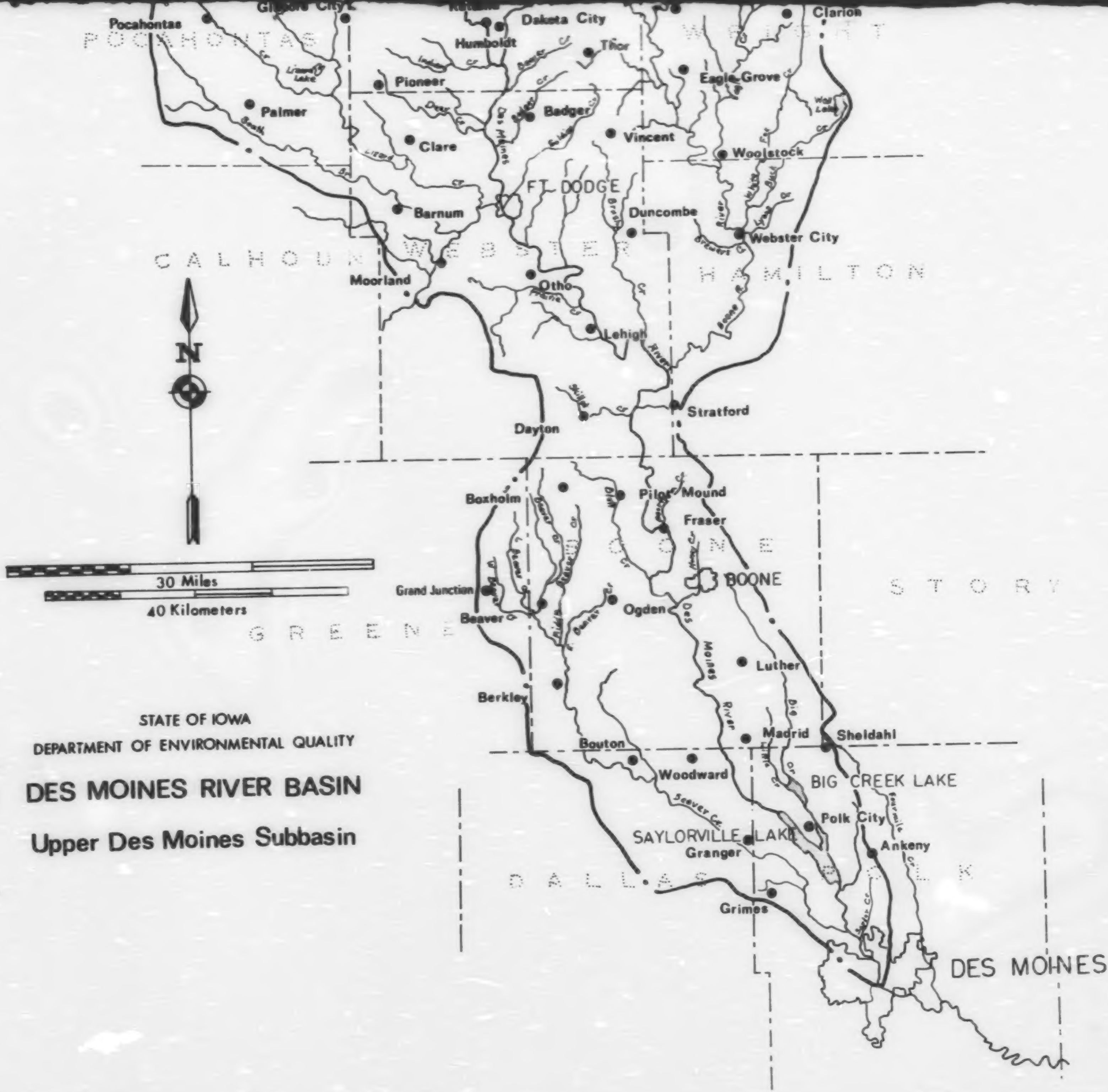
A synopsis of the basin planning process is presented along with a brief description of the DEQ's water quality management program and strategy.

II. Existing Development Patterns

Information concerning population, land use economics and recreational activities within the basin is presented.

A


MINNESOTA
Blue Earth
Rake
Dolliver
Estherville
Gruver
Armstrong
Swea City
Ledyard
Lakota
Buffalo Center
WINNEBAGO
EMMET
Wallingford
Ringsted
Bancroft
Graettinger
Fenton
Lone Rock
Burt
Titonka
KOSSUTH
Five Island Lake
Emmetsburg
Cylinder
Whittmore
Algona
Wesley
Britt
PALO ALTO
HANCOCK
Silver Lake
Ayrshire
Rodman
Des Moines
Curlew
Corwith
West Bend
Mallard
Lu Verne
Kanawha
Ottosen
Bode
Livermore
Plover
Havelock
Rolfe
Hardy
Renwick
Bradgate
HUMBOLDT
Rutland
Gilmore City
Goldfield
Clarion
Pocahontas
POCAHONTAS
Dakota City
Humboldt
Thor
WRIGHT
Pioneer
Eagle Grove
Palmer
Badger
Clare
Vincent
Woolstock
FT. DODGE
Barnum
Duncombe
Webster City
CALHOUN
WEBSTER
HAMILTON
Moorland
Otho


Pocahontas
POCAHONTAS
Gilmore City
Humboldt
Dakota City
Thor
WRIGHT
Clarion
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Eagle Grove
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Badger
Vincent
Clare
Woolstock
FT DODGE
Barnum
Duncombe
Webster City
CALHOUN
WEBSTER
HAMILTON
Moorland
Otho
Lehigh
River
Stratford
Dayton
Boxholm
Pilot Mound
Fraser
BOONE
Grand Junction
Beaver
Ogden
STORY
GREENE
Luther
Berkley
Madrid
Sheldahl
Bouton
Woodward
BIG CREEK LAKE
Polk City
SAYLORVILLE LAKE
Granger
Ankeny
DALLAS
POLK
Grimes
DES MOINES
Des Moines River
N
30 Miles
40 Kilometers

STATE OF IOWA
DEPARTMENT OF ENVIRONMENTAL QUALITY

DES MOINES RIVER BASIN

Upper Des Moines Subbasin

B

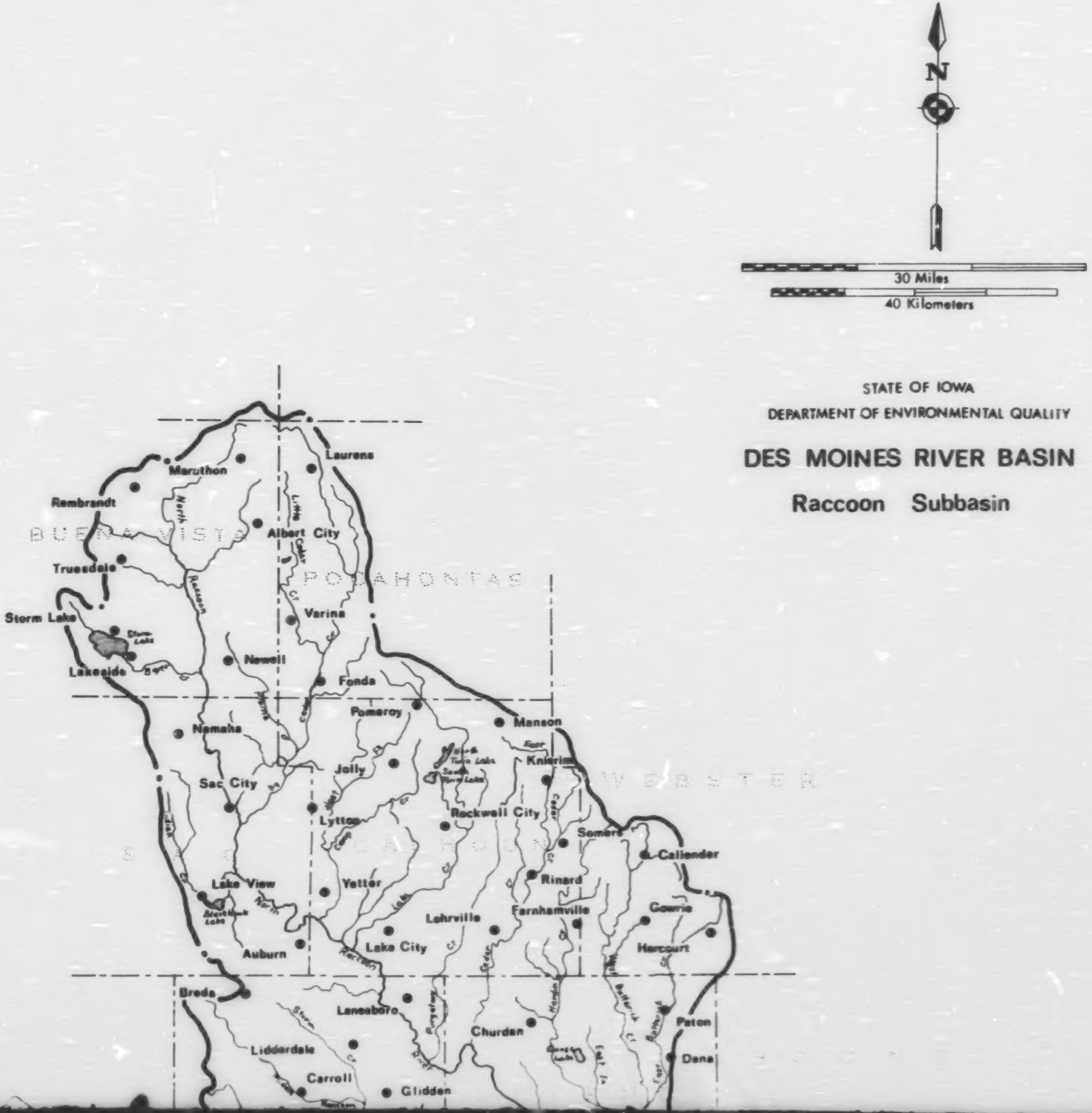
Figure 2

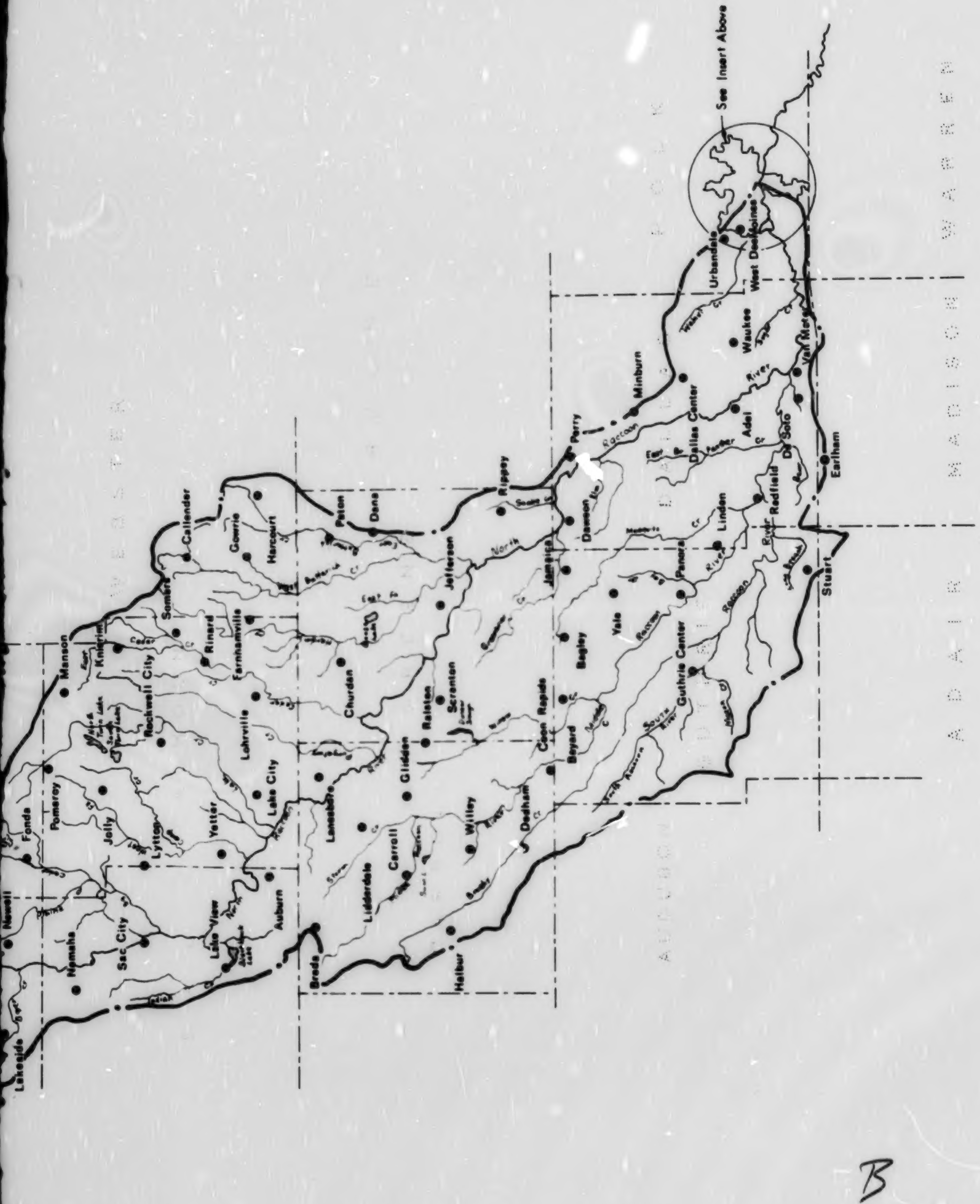
A

STATE OF IOWA
DEPARTMENT OF ENVIRONMENTAL QUALITY

DES MOINES RIVER BASIN

Raccoon Subbasin


N
30 Miles
40 Kilometers
BUENA VISTA
POCAHONTAS
WEBSTER
CALHOUN
SAC
Laurens
Maruthon
Rembrandt
Albert City
Truesdale
Storm Lake
Storm Lake
Varina
Newell
Lakeside
Fonda
Pomeroy
Manson
Namaha
Jolly
Knierim
Twin Lake
Sac City
Lytton
Rockwell City
Somers
Callender
Rinerd
Lake View
Yetter
Lohrville
Farnhamville
Gowrie
Auburn
Lake City
Harcourt
Breda
Lanesboro
Churdan
Paton
Lidderdale
Dana
Carroll
Glidden
North
Raccoon
Little Cedar
Cedar
Storm
Raccoon
Purgatory
Hardin
East Fk
Buttrick Cr
Cr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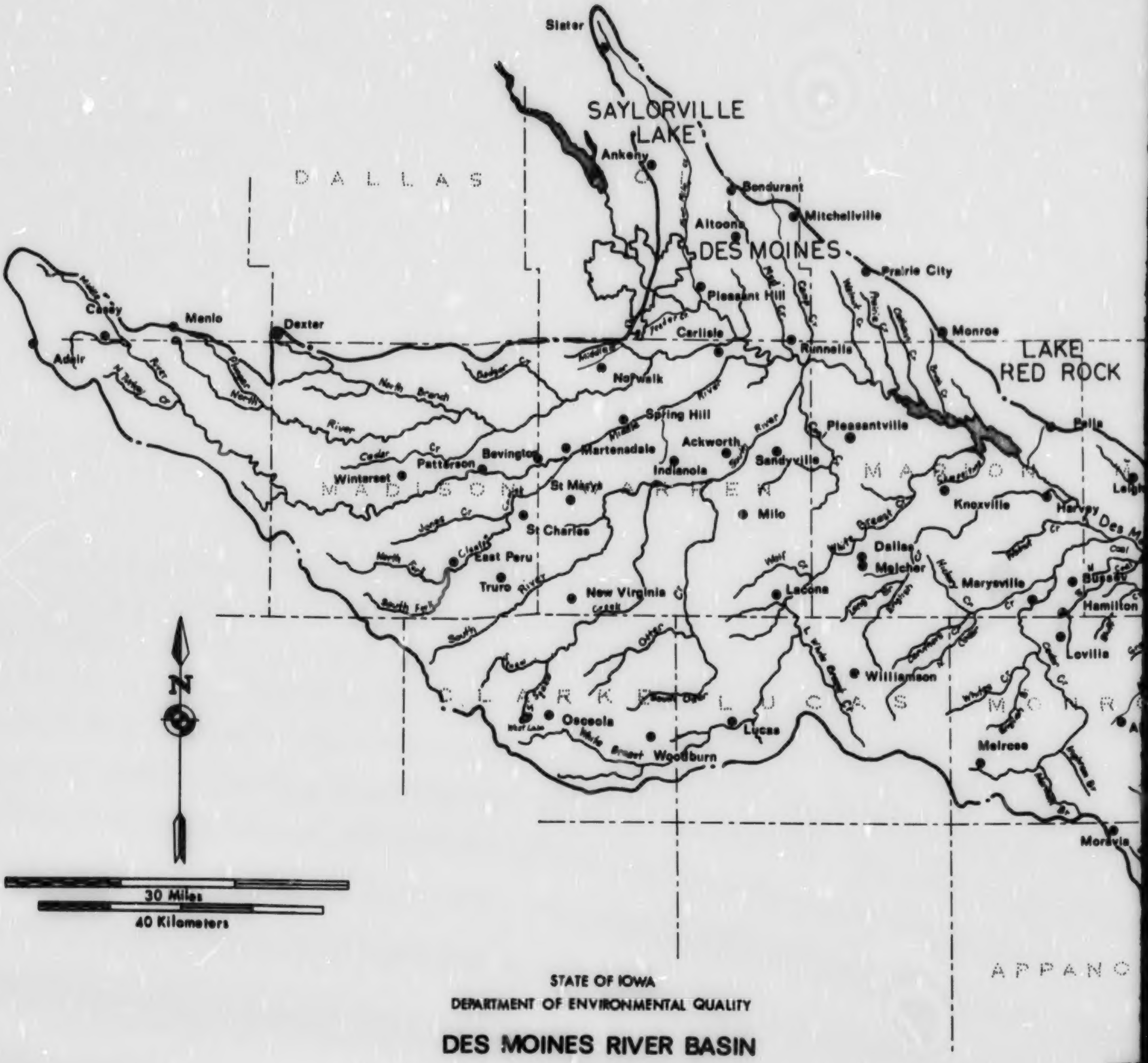
P O L K
W A R R E N
M A D I S O N
A D A I R
Urbandale
West Des Moines
Waukee
Van Meter
Minburn
Dallas Center
Adel
De Soto
Earlham
Perry
Raccoon River
Redfield
Linden
Stuart
Panora
Rippey
Dawson
Jamaica
Callender
Gowrie
Harcourt
Paton
Dana
Jefferson
Somers
Rinard
Farnhamville
Yale
Bagley
Guthrie Center
Churdan
Scranton
Ralston
Coon Rapids
Bayard
Manson
Knierim
Rockwell City
Lohrville
Lake City
Glidden
Lanesboro
Carroll
Willey
Dedham
Pomeroy
Fonda
Jolly
Lytton
Yetter
Lidderdale
Auburn
Lake View
Sac City
Newell
Nemaha
Breda
Halbur
Lakeside
AUDUBON

B

FIGURE


Slater
SAYLORVILLE LAKE
Ankeny
DALLAS
Bondurant
Mitchellville
Altoona
DES MOINES
Prairie City
Pleasant Hill
Monroe
LAKE RED ROCK
Casey
Menlo
Dexter
Carlisle
Runnells
Adair
Norwalk
North Branch
River
Badger Cr
Middle River
Spring Hill
Pleasantville
Pella
Cedar Cr
Bevington
Martensdale
Ackworth
Patterson
Winterset
Indianola
Sandyville
MADISON
WARREN
MARION
St Marys
Knoxville
Harvey
Des Moines
Milo
St Charles
Jones Cr
Clanton Cr
North Fork
South Fork
East Peru
Truro
Dallas
Melcher
Marysville
Bussey
New Virginia
Lacona
Hamilton
White Breast Cr
Wolf Cr
Otter
Lovilla
Williamson
N
CLARKE
LUCAS
MONROE
Osceola
Lucas
Woodburn
Melrose
Moravia
30 Miles
40 Kilometers
APPANO

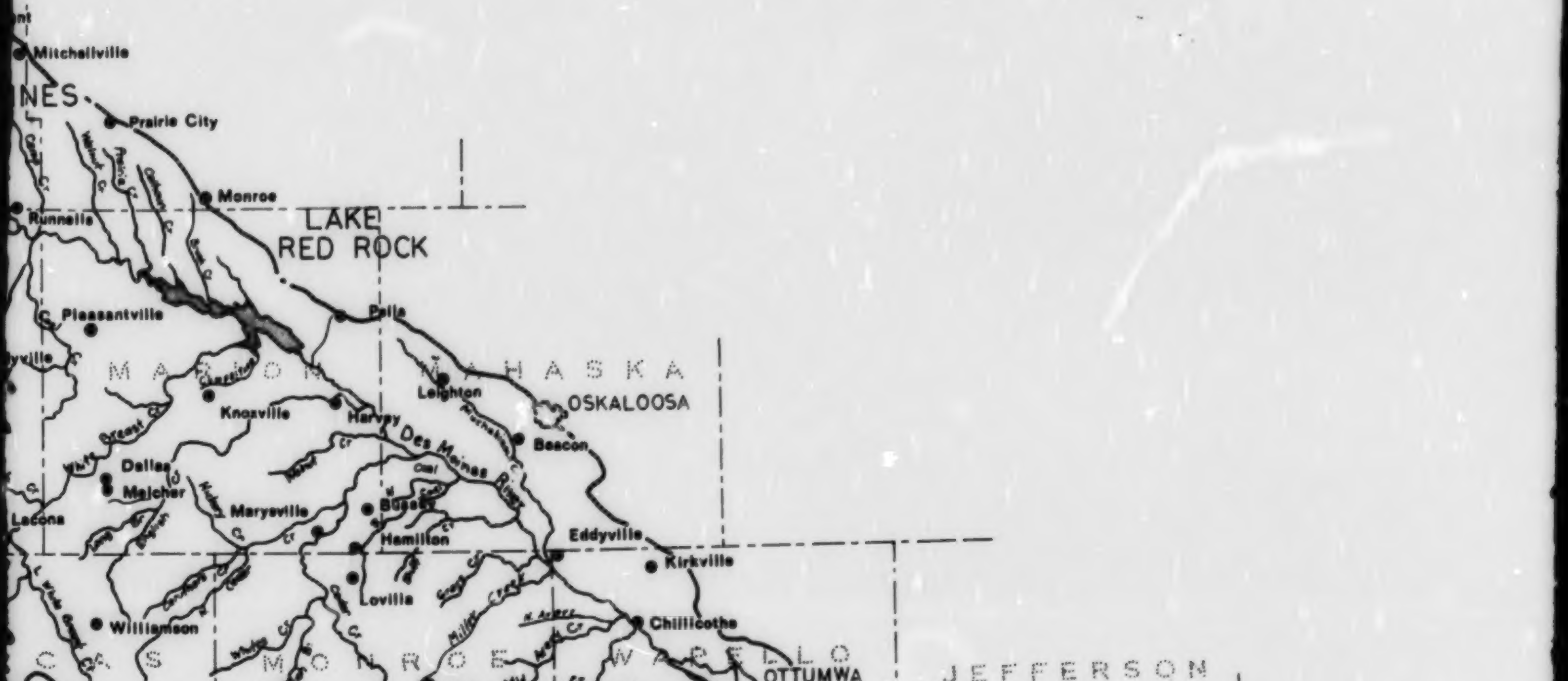
STATE OF IOWA

DEPARTMENT OF ENVIRONMENTAL QUALITY

DES MOINES RIVER BASIN

Lower Des Moines Subbasin

A


Mitchellville
INES
Prairie City
Monroe
Runnells
LAKE RED ROCK
Pleasantville
Pella
MARION
MAHASKA
Knoxville
Harvey
Leighton
OSKALOOSA
Beacon
Des Moines River
Dallas
Melcher
Maryville
Bussey
Hamilton
Lacona
Eddyville
Kirkville
Lovilla
Williamson
Chillicothe
LUCAS
MONROE
WAPELLO
OTTUMWA
JEFFERSON
Albia
Melrose
Blakesburg
Libertyville
Eldon
Moravia
Floris
DAVIS
VAN BUREN
APPANOOSE
Keosauqua
Bonaparte
Farmington
Donnellson
LEE
MISSOURI
KEOKUK

B

FIGURE 4

III. **Basin Characteristics**

The physical characteristics of the basin, including topography, climatology, physiography, geology, hydrogeology, hydrology, and ground water quality are discussed.

IV. **Water Quality**

Iowa Water Quality Standards and Stream Classifications are delineated. Available water quality data have been accumulated and evaluated to present the best possible picture of the recent history of basin water quality. Existing water quality is described and then compared with the Iowa Water Quality Standards.

V. **Point Source Discharge Inventory**

Available records have been reviewed to determine the location and characteristics of point source wastewater discharges. This information is tabulated and summarized.

VI. **Waste Load Allocations and Rankings**

The results of the waste load allocation analyses for the basin are listed. Waste load reductions for each point source waste dischargers are given. Segments are classified and ranked. Dischargers are ranked.

VII. **Nonpoint Pollution Sources**

The problems of nonpoint pollution sources are addressed. Combined sewer overflows, urban runoffs, and rural sources of pollution from animal feeding operations and general agricultural activities are characterized. Based upon information extrapolated from other areas, the potential pollution from typical sources is identified.

VIII. Needs and Compliance Schedules

An evaluation of the needs for improved wastewater treatment in the basin is presented. A summary of the estimated costs associated with these needs is also given.

IX. Conclusions and Recommendations

Conclusions drawn from the plan are presented along with several recommendations that would aid in attaining the goal of improved water quality.

X. Review and Revision

The procedures for review and revision of this plan are briefly described.

TABLE OF CONTENTS

Page

Title Page i
Acknowledgments ii
Foreword iii
Scope vi
Table of Contents xii
List of Tables xiv
List of Figures xvii

Chapter

I Iowa's Water Quality Management Program

- Water Quality Standards I- 1
- Implementation Strategy I- 4
- References I-31

II Existing Development Patterns

- Political Subdivisions II- 1
- Population Projection II- 1
- Economics II-12
- Recreational Activities II-17
- References II-33

III Basin Characteristics

- Lakes and Impoundments III- 5
- Physiographic Features III- 5
- General Climatology III-18
- Surface Waters III-20
- Hydrogeology III-34
- Ground Water Quality III-39
- References III-41

IV Water Quality

- Sampling Locations IV- 8
- Des Moines River IV-12
- East Fork Des Moines River IV-27
- West Fork Des Moines River IV-32
- North Raccoon River IV-44
- North, Middle and South Rivers IV-54
- References IV-56

V Point Source Discharge Inventory

- Municipal V- 3
- Semipublic V- 4
- Industrial V- 4
- Summary V- 5

TABLE OF CONTENTS (CONTINUED)

Chapter		Page
VI	Waste Load Allocations and Rankings	
	Allocation Results	VI-16
	Segment Classification	VI-44
	Priority Rankings	VI-50
	References	VI-70
VII	Nonpoint Pollution Sources	
	General Rural Runoff	VII- 1
	Animal Feeding Operations	VII- 8
	Urban Runoff	VII-22
	References	VII-24
VIII	Needs and Compliance Schedules	
	Assessment of Needs	VIII- 1
	References	VIII-42
IX	Conclusions and Recommendations	
	Conclusions	IX- 1
	Recommendations	IX- 4
X	Review and Revision	
	Public Hearing Procedure	X- 1
	Water Quality Standards Review	X- 2
	Basin Plan Revision	X- 2
	Basin Plan Hearings	X- 3
	Glossary	

LIST OF TABLES

Number		Page
II-1	Portions of Counties - The Des Moines River Basin	II- 2
II-2	Existing and Projected Populations	II- 6
II-3	Economic Profile of the Des Moines River Basin	II-13
II-4	Summary Economic Data for Selected Area Shown in Figure II-4	II-14
II-5	Existing and Proposed Recreation Facilities - UDMRS	II-20
II-6	Existing and Proposed Recreation Facilities - RRS	II-25
II-7	Existing and Proposed Recreation Facilities - LDMRS	II-29
III-1	Drainage Areas of Streams in the Des Moines River Basin	III- 3
III-2	Des Moines River Basin - Lakes and Impoundments	III- 6
III-3	Annual Runoff and Indicators of Flow Variability for Selected Stations in the Des Moines River Basin	III-21
III-4	U.S.G.S. Gaging Station Information - UDMRS	III-25
III-5	U.S.G.S. Gaging Station Information - RRS	III-28
III-6	U.S.G.S. Gaging Station Information - LDMRS	III-31
III-7	Flow Comparisons	III-35
IV-1	Surface Water Classification - Des Moines River Basin	IV- 3
IV-2	Heavy Metals in the Des Moines River (Fort Dodge to Des Moines)	IV-14

NOTE: UDMRS - Upper Des Moines River Subbasin
RRS - Raccoon River Subbasin
LDMRS - Lower Des Moines River Subbasin

LIST OF TABLES (CONTINUED)

Number		Page
IV-3	Heavy Metals in the Des Moines River (Des Moines to Keokuk)	IV-14
IV-4	Pesticides in the Des Miones River	IV-15
IV-5	Heavy Metals in the East Fork Des Moines River	IV-29
IV-6	Heavy Metals in the West Fork Des Moines River	IV-34
IV-7	Water Quality Iowa-Minnesota Border 1967-1973	IV-43
IV-8	Heavy Metals in the North Raccoon River	IV-47
IV-9	Heavy Metals in the Main Stem Raccoon River	IV-47
IV-10	Pesticides in the Main Stem Raccoon River	IV-48
IV-11	Bacteriological Data - North Raccoon River	IV-53
V-1	Point Source Wastewater Discharges	V- 7
V-2	Discharge Inventory	V-22
V-3	Des Moines River Basin Point Source Wastewater Discharge Summary	V-68
V-4	Municipal Wastewater Treatment Facility Process Summary	V-70
V-5	Des Moines River Basin Municipal Wastewater Treatment Facility Process Summary	V-72
VI-1	Waste Load Allocations	VI- 2
VI-2	Stream Segment Ranking	VI-45
VI-3	Waste Load Reductions	VI-51
VI-4	Municipal Discharger Ranking	VI-61
VII-1	Land Use Classifications	VII- 2
VII-2	Estimated Annual Nutrient Load in the Des Moines River at Saylorville	VII- 4
VII-3	Estimated Nutrient Loadings from Nonpoint Sources	VII- 4

LIST OF TABLES (CONTINUED)

Number		Page
VII- 4	Runoff Control Measures Required - Des Moines River Basin	VII- 5
VII- 5	Unit Costs for Statewide Controls	VII- 6
VII- 6	Runoff Control Costs by Subbasin - Des Moines River Basin	VII- 7
VII- 7	Livestock Distribution by Subbasin - Des Moines River Basin	VII- 9
VII- 8	Animal Feeding Operations - UDMRS	VII-11
VII- 9	Animal Feeding Operations - RRS	VII-15
VII-10	Animal Feeding Operations - LDMRS	VII-18
VII-11	Livestock Treatment Cost	VII-21
VII-12	Urban Stormwater Treatment and/or Control Costs	VII-23
VIII- 1	Average Disposal Costs	VIII- 7
VIII- 2	Municipal Assessment of Needs and Schedule of Compliance	VIII-10
VIII- 3	Summary of Municipal Treatment Needs	VIII-34
VIII- 4	Treatment of Needs and Schedule of Compliance	VIII-37
VIII- 5	Summary of Needs	VIII-41

LIST OF FIGURES

Number		Page
II- 1	Population Distribution - UDMRS	II- 3
II- 2	Population Distribution - RRS	II- 4
II- 3	Population Distribution - LDMRS	II- 5
II- 4	Data Base Area for Employment Statistics	II-15
II- 5	Recreational Site Inventory - UDMRS	II-24
II- 6	Recreational Site Inventory - RRS	II-28
II- 7	Recreational Site Inventory - LDMRS	II-32
III- 1	Des Moines River Basin	III- 2
III- 2	Generalized Geologic Column for Iowa	III-13
III- 3	Glacial Geography of Iowa	III-14
III- 4	Major Soil Groups in the Des Moines River Basin	III-17
III- 5	U.S.G.S. Gaging Stations - UDMRS	III-27
III- 6	U.S.G.S. Gaging Stations - RRS	III-30
III- 7	U.S.G.S. Gaging Stations - LDMRS	III-33
IV- 1	Surface Water Classification - UDMRS	IV- 5
IV- 2	Surface Water Classification - RRS	IV- 6
IV- 3	Surface Water Classification - LDMRS	IV- 7
IV- 4	Selected Water Quality Sampling Locations - UDMRS	IV- 9
IV- 5	Selected Water Quality Sampling Locations - RRS	IV-10
IV- 6	Selected Water Quality Sampling Locations - LDMRS	IV-11
IV- 7	Turbidity Profiles for the Lower Des Moines River	IV-16
IV- 8	Temperature Profiles for the Lower Des Moines River	IV-18

LIST OF FIGURES (CONTINUED)

Number		Page
IV- 9	Dissolved Oxygen Profiles for the Lower Des Moines River	IV-19
IV-10	Dissolved Oxygen Profiles for the Lower Des Moines River	IV-20
IV-11	Comparison of Biochemical Oxygen Demand in the Des Moines River - 1960's vs. 1970's	IV-21
IV-12	Comparison of Ammonia Nitrogen Concentrations in the Des Moines River - 1940's vs. 1960's vs. 1970's	IV-22
IV-13	Comparison of Mean Biochemical Oxygen Demand Concentrations for the Des Moines River, 1940's vs. 1970's	IV-24
IV-14	Fecal Coliform Profiles for the Lower Des Moines River	IV-26
IV-15	East Des Moines River Basin Map	IV-28
IV-16	East Fork Des Moines River, Dissolved Oxygen Concentration	IV-30
IV-17	East Fork Des Moines River, Ammonia Nitrogen Concentration	IV-30
IV-18	East Fork Des Moines River, Fecal Coliform Count	IV-31
IV-19	West Des Moines River Basin Map	IV-33
IV-20	Mean Nitrate Nitrogen Concentrations in the West Fork Des Moines River, 1970-1974	IV-35
IV-21	Mean Turbidity Concentrations in the West Fork Des Moines River, 1970-1974	IV-36
IV-22	Mean Ammonia Nitrogen Concentrations in the West Fork Des Moines River, 1970-1974	IV-37
IV-23	Mean Biochemical Oxygen Demand in the West Fork Des Moines River, 1970-1974	IV-38
IV-24	Mean Fecal Coliform Concentrations in the West Fork Des Moines River, 1970-1974	IV-39
IV-25	West Fork Des Moines River, Dissolved Oxygen Concentrations	IV-41

LIST OF FIGURES (CONTINUED)

Number		Page
IV-26	West Fork Des Moines River, Ammonia Nitrogen Concentrations	IV-41
IV-27	West Fork Des Moines River, Fecal Coliform Count	IV-43
IV-28	North Raccoon River Basin Map	IV-45
IV-29	North Raccoon River, Dissolved Oxygen Concentrations	IV-49
IV-30	North Raccoon River, Ammonia Nitrogen Concentrations	IV-49
IV-31	North Raccoon River, Dissolved Oxygen Concentrations	IV-50
IV-32	North Raccoon River, Ammonia Nitrogen Concentrations	IV-50
V- 1	Point Source Wastewater Dischargers - UDMRS	V-19
V- 2	Point Source Wastewater Dischargers - RRS	V-20
V- 3	Point Source Wastewater Dischargers - LDMRS	V-21
VI- 1	Dissolved Oxygen and Ammonia Nitrogen Concentration Profiles, Summer Conditions, West Fork Des Moines River	VI-17
VI- 2	Dissolved Oxygen and Ammonia Nitrogen Concentration Profiles, Summer Conditions, East Fork Des Moines River	VI-18
VI- 3	Dissolved Oxygen and Ammonia Nitrogen Concentration Profiles, Summer Conditions, Lotts Creek	VI-19
VI- 4	Dissolved Oxygen and Ammonia Nitrogen Concentration Profiles, Summer Conditions, Boone River	VI-20
VI-5	Dissolved Oxygen and Ammonia Nitrogen Concentration Profiles, Summer Conditions, Main Stem Upper Des Moines River	VI-21
VI-6	Dissolved Oxygen and Ammonia Nitrogen Concentration Profiles, Winter Conditions, West Fork Des Moines River	VI-23

LIST OF FIGURES (CONTINUED)

Number		Pages
VI- 7	Dissolved Oxygen and Ammonia Nitrogen Concentration Profiles, Winter Conditions, East Fork Des Moines River	VI-24
VI- 8	Dissolved Oxygen and Ammonia Nitrogen Concentration Profiles, Winter Conditions, Lotts Creek	VI-25
VI- 9	Dissolved Oxygen and Ammonia Nitrogen Concentration Profiles, Winter Conditions, Boone River	VI-26
VI-10	Dissolved Oxygen and Ammonia Nitrogen Concentration Profiles, Winter Conditions, Main Stem Upper Des Moines River	VI-27
VI-11	Dissolved Oxygen Concentration Profiles, Summer Conditions, South Raccoon River and Middle Raccoon River	VI-28
VI-12	Dissolved Oxygen Concentration Profiles, Summer Conditions, North Raccoon River and Raccoon River	VI-29
VI-13	Ammonia Nitrogen Concentration Profiles, Summer Conditions, South Raccoon River and Middle Raccoon River	VI-30
VI-14	Ammonia Nitrogen Concentration Profiles, Summer Conditions, North Raccoon River and Raccoon River	VI-31
VI-15	Dissolved Oxygen Concentration Profiles, Winter Conditions, South Raccoon River and Middle Raccoon River	VI-33
VI-16	Dissolved Oxygen Concentration Profiles, Winter Conditions, North Raccoon River and Middle Raccoon River	VI-34
VI-17	Ammonia Nitrogen Concentration Profiles, Winter Conditions, South Raccoon River and Middle Raccoon River	VI-35
VI-18	Ammonia Nitrogen Concentration Profiles, Winter Conditions, North Raccoon River and Raccoon River	VI-36

LIST OF FIGURES (CONTINUED)

Number		Page
VI-19	Dissolved Oxygen and Ammonia Nitrogen Concentration Profiles, Summer Conditions, Des Moines River	VI-38
VI-20	Dissolved Oxygen and Ammonia Nitrogen Concentration Profiles, Summer Conditions, Beaver Creek	VI-39
VI-21	Dissolved Oxygen and Ammonia Nitrogen Concentration Profiles, Summer Conditions, Middle River	VI-40
VI-22	Dissolved Oxygen and Ammonia Nitrogen Concentration Profiles, Winter Conditions, Des Moines River	VI-41
VI-23	Dissolved Oxygen and Ammonia Nitrogen Concentration Profiles, Winter Conditions, Beaver Creek	VI-42
VI-24	Dissolved Oxygen and Ammonia Nitrogen Concentration Profiles, Winter Conditions, Middle River	VI-43
VI-25	Stream Segments, Upper Des Moines River Basin	VI-47
VI-26	Stream Segments, Raccoon River Basin	VI-48
VI-27	Stream Segments, Lower Des Moines River Basin	VI-49
VII- 1	Animal Feeding Operations - UDMRS	VII-10
VII- 2	Animal Feeding Operations - RRS	VII-14
VII- 3	Animal Feeding Operations - LDMRS	VII-17

CHAPTER I

IOWA'S WATER QUALITY MANAGEMENT PROGRAM

The main objective of water quality management is protection and enhancement of water resources to insure acceptable conditions for designated uses. The establishment of a realistic management program requires a comparison of existing water quality with the desired water quality.

The Iowa Water Quality Standards, as adopted by the Iowa Water Quality Commission, establish a baseline for desired water quality and stream uses. The National Water Quality Criteria, as proposed by the U.S. Environmental Protection Agency (EPA), provides an additional measure of desirable water quality.

WATER QUALITY STANDARDS

Iowa's Water Quality Standards and accompanying use classifications were established by the Water Quality Commission. They were adopted by the State on February 12, 1974 and approved by the U.S. Environmental Protection Agency on March 26, 1974. When a water quality standard is violated the water, according to law, is polluted and its quality must be improved.

Water Use Classifications

The Department of Environmental Quality has responsibility for establishment of water use classifications for the surface waters of the State. Assistance in this task has been provided by the State Conservation Commission which has the major responsibility for fish and wildlife protection. Accordingly, the DEQ has defined four surface water-use classifications and has placed all surface waters of the State into one or more of these classifications. These classifications are:

Class A - Primary Contact Recreation; Class B - Wildlife, Secondary Contact Recreation and Aquatic Life (with subclasses for cold and warm waters); Class C - Potable Water Supply; and a General Water Quality Criteria. All surface waters are designated under the General Water Quality Criteria. In addition, many streams are also designated for one or more of the Class A, Class B, or Class C uses. Each of the use classifications imply specific water quality standards.

Surface Water Quality Standards

Iowa Water Quality Standards define the constituent levels which may be present in the surface waters of the State. Specific concentrations of various constituents which should not be violated are assigned to each water use, in order to protect the water for that particular use.

The water quality standards shall be met at all times when the flow of the receiving stream equals or exceeds the seven day, 1-in-10 year low flow (7Q10). Exceptions may be made for intermittent or extremely low flow streams. When intermittent streams are classified for aquatic life protection, the Water Quality Commission may waive the (7Q10) low flow requirement and establish a minimum flow in lieu thereof. Such a waiver shall be granted by the Commission only when it has been determined that the aquatic resources of the receiving waters are of little significance at flows less than the established minimum.

The specific criteria which apply to A, B, C, or General classifications are detailed in Chapter II of the Supporting Document For Iowa Water Quality Management Plans (1).

Revision of Water Quality Standards

The Act requires that the State shall from time to time, but at least once every three years, hold public hearings to review water quality standards and, if appropriate, modify and adopt new standards.

Some of the most likely changes in the Standards will be revisions of the use classifications. Since the National water quality goal is swimmable-fishable waters by 1983, most anticipated changes will be to upgrade existing Class B waters to include the current Class A usage. There will also be cases of upgrading waters, to which only general criteria apply, Classes A and B. Other revisions that may take place are changes in the criteria of the current Water Quality Standards. Any revisions in the Standards will be subject to public hearings and approval by the EPA before they may become law.

IMPLEMENTATION STRATEGY

If a management plan is to be effective, it must include a strategy for implementation of its proposals. This section gives a brief description of the DEQ's strategy for the implementation of its basin plans.

Strategy Summary

In most cases, water quality violations are the result of man's activities. Typical sources of pollution can include municipal discharges, industrial discharges, and runoff or nonpoint discharges associated with agricultural practices. The solution to water pollution is to identify the contributing sources and either eliminate or control them to the extent necessary to assure that water quality standards will not be violated.

Waste load allocation studies are performed to estimate the quantities of pollutants which may be discharged to receiving waters without exceeding the limits allowed by the water quality standards. Through the use of the waste load allocations, effluent limitations are established for municipal and industrial wastewater point source discharges. Only point sources of pollution are addressed in the waste load allocations in the initial version of the basin plans. This is because point sources of pollution are easier to identify and control. Nonpoint sources of pollution will receive further considerations in subsequent revisions to the plans.

Regardless of what the waste load allocation study indicates, to be allowable, the Federal Water Pollution Control Act Amendments of 1972 (the Act), Public Law 92-500, requires publicly owned treatment plants to provide as a minimum, "secondary treatment", and industrial plants to provide, as a minimum, "best practicable control technology currently available" (B. P. T.) by July 1, 1977. The actual effluent limitations required under these degrees of treatment are described in Chapter VI.

The principal mechanism for attaining and maintaining compliance with the water quality standards is through the issuance of operation permits to all point sources of wastewater discharge. The permits contain either minimum allowable effluent limitations or limitations more stringent as necessary to assure compliance with water quality standards. Where existing sources are not in compliance with the effluent limitations, the operation permit will include an implementation schedule to assure compliance within a reasonable time period.

An additional step in the implementation of remedial measures to abate water pollution exists in the case of municipal wastewater treatment plants. Public Law 92-500, the Act, has established a program for assisting publicly owned waste treatment works with funding for improvements necessary to meet the goals of the Act. The DEQ, as the state water pollution control agency, has responsibility for administering the program. The final step, then, in the DEQ's strategy for implementation of the plan is to allocate the federal funds available for improvement of Iowa municipal treatment facilities.

Monitoring and Surveillance

Stream Sampling Station Network - The present Iowa stream sampling station network is a series of sampling points distributed throughout the State. These are permanent stations, sampled at the same location and on a quarterly frequency. The samples are normally analyzed for the same parameters every quarter. The objective of the sampling network is to give a general indication of water quality. The network is effective for measuring trends of either improvement or degradation of water quality. Although only minimal assistance is obtained in the area of enforcement, the network provides some background data for planning and assessing the effectiveness of the program.

The present network consists of thirty-six (36) stations across Iowa, each sampled quarterly. Six of these stations are in the Des Moines River Basin. Five of the six stations are on the Des Moines River. The five stations are located at Humboldt, at Dakota City, at Des Moines, at the Ottumwa Water Works Intake, and at Alexandria Bridge near Keokuk. The one station on the Raccoon River is located at the Des Moines Water Treatment Plant intake. All stations are sampled by the State Hygienic Laboratory of the University of Iowa, under contract to the DEQ. The State Hygienic Laboratory also does the analyses.

In order to be more effective as a trend indicator, the monitoring network should be expanded. To be most effective, stations should be located below major point source discharges, and at points on the stream of distinct change in characteristic. These locations would be at points of confluence of major tributaries, above and below impoundments, and at points of change of water quality standards designation.

Intensive Stream Water Quality Surveys- The limiting factor in the effectiveness of the stream sampling network is its inability to detect cause and effect relationships. The DEQ's water quality monitoring program therefore includes a complementary program of intensive stream water quality surveys. The intensive surveys are in-depth studies of water quality in a specific area or segment of a stream, over a finite time period. The purpose of the survey is to provide a detailed determination of the biological, physical, and chemical qualities of the stream water. Information obtained is used to determine the effects of a specific point source or combination of point sources upon the receiving stream. The surveys provide documentation for enforcement actions and determine the effectiveness of any corrective measures initiated. Such surveys are also used for evaluating priorities, verifying waste load allocations, and as aids for planning.

The bulk of the intensive surveys program is conducted by the State Hygienic Laboratory. The lab usually performs both sampling and sample analyses. Intensive surveys are also conducted by the DEQ staff to obtain answers to specific questions. For example, limited surveys are occasionally conducted by DEQ Regional staff in connection with point source discharge compliance inspections.

All survey data storage and analysis are performed using computer data processing. The stream water quality data is also stored in the U.S. Environmental Protection Agency computer storage system, STORET. The STORET system includes a variety of report and analysis formats for evaluating and using the data.

Point Source Discharge Self-Monitoring - The principal tool for the management of point source discharge monitoring and enforcement of effluent limitations is the State Operation Permit Program, in coordination with the National Pollutant Discharge Elimination System (NPDES Discharge Permit Program). The permits not only set discharge effluent limitations and prescribe compliance schedules for bringing about corrections, but also specify a program for effluent monitoring and recording by the permit holder.

Dischargers are currently required to report to the DEQ each month. Report contents are specified and are tailored to the size and complexity of the plant and to the effluent limitations specified in the permit. Plant flows are required to be recorded as well as certain laboratory test results.

The self-monitoring reports are used as a screening mechanism to point out operation problems and existing or impending effluent limit violations. The reports are used as a guide to direct the DEQ resources to the needs for more detailed monitoring and possible enforcement action.

More importantly, however, the reports serve as an aid to the operator in evaluating his own operation. The requirements in effect mandate the availability of operational data which the operator can then use to improve his operation.

Another self-monitoring program is the State initiated Effluent Quality Analysis Program (EQAP). This is a program where the State Hygienic Laboratory mails specially prepared sample bottles to each discharger. The plant operator collects a sample at times and locations recommended by the DEQ, and mails the sample back to the State Hygienic Laboratory for analysis. Samples are analyzed monthly for biochemical oxygen demand (BOD) and, in some cases, ammonia. Other water quality parameters compatible with acid fixing can also be analyzed from the EQAP sample. Occasionally, heavy metal or phosphorus analyses are performed at the request of the DEQ.

Plant Inspection - The DEQ also conducts on-site plant inspections. The purpose of the inspection is to provide an in-depth analysis of the operation, maintenance, and effectiveness of the treatment plant. The inspections provide verification of self-monitoring reports and determination of whether the plant is in compliance with permit stipulations.

Influent and effluent samples are collected and analyzed when possible, but in many cases visual observations of the effluent by the inspector can satisfactorily make the determination. The inspection also includes an evaluation of the effects of the effluent on the receiving stream, occasionally by sampling, but more often by visual observation.

The advantage of the on-site inspection over the other monitoring programs is the opportunity to make cause and effect evaluations. The inspector can observe the raw waste load and the operation and maintenance factors which determine the efficiency and effectiveness of the treatment process.

The value of the inspections is twofold; first, they provide a valuable tool for evaluating permit compliance and documenting the need for enforcement actions, and secondly, and equally important, they provide a vehicle for assistance to the operator. The inspectors can provide counsel and advice to the local officials on meeting permit requirements as well as operation and maintenance methods to improve plant operation and efficiency.

Plant inspections are normally made by the DEQ regional staff. The regional staff make the inspections when minimal or no sampling is needed in conjunction with the inspection. Central office staff make inspections when intensive composite sampling is required. The number of inspections conducted each year is limited by the availability of fiscal and personnel resources. Approximately three to four hundred municipal and industrial inspections are made each year, along with a similar number of quick stop visits. All municipal and major industrial plants should be inspected each year. The number of inspections will be increased as staff is added to the Regional offices.

Waste Load Allocations

Waste load allocations have been made for point sources of wastewater discharge in order to maintain water quality standards. The scope of the allocations was limited to evaluation of effluent limitations necessary to meet the dissolved oxygen (DO) and ammonia-nitrogen (NH_3-N) standards, at the 7-day, 1-in-10 year low stream flow.

The DO and NH_3-N parameters were selected for evaluation because they are generally the most critical criteria of the water quality standards. Data from five years of municipal treatment plant effluent sampling are available on these parameters and are readily adaptable to data processing. Other criteria within the water quality standards can normally be met with secondary treatment.

It is recognized that other parameters could be considered in the waste load allocation analyses. An analysis of historical water quality data shows that other water quality criteria have been violated and that critical conditions may also exist for some parameters during high stream flow periods. Some other parameters of particular concern include heavy metals, toxic elements, fecal coliform and thermal discharges. Where standards violations are apparent for parameters other than DO and NH_3-N they are studied on an individual basis and effluent limits incorporated into the operation permits. A more detailed waste load allocation analysis, however, will have to be left until subsequent revisions of this plan when additional data and information become available.

To predict the variation in DO and ammonia concentrations in the streams, a computer-based mathematical model was used. Input data for the model was developed from existing information and cursory field investigations of the streams. When necessary, conservative assumptions have been made that tend to assure a high degree of protection for water quality without necessitating unrealistically stringent effluent limitations. Future stream surveillance should help to verify particular constants and assumptions used, and improve the validity of the model. Based upon existing data prediction of the impact of different wastewater loads upon the DO and ammonia concentrations may be performed.

detailed discussion of the mathematical model, methodology, and assumptions used in the waste load allocation analysis is included in Chapter IV of the supporting document (1). The final allocations for the Des Moines River Basin are contained in Chapter VI of this report.

Permit System

The major mechanism by which the water quality management plan will be implemented is the wastewater construction and operation permit program conducted by the DEQ, under authority of Chapter 19, of the rules of the Department (1973 IDR). Any person intending to construct, modify or extend any wastewater disposal system in the State of Iowa must first obtain a construction permit from the Executive Director of DEQ. An operation permit is also required prior to the operation of any disposal system, or the discharge of sewage, industrial waste, or other wastes from any discharge source. Chapter 455B of the Code also has provisions included for correcting violations of any permit, rule, standard, or order issued under Part 1 of Division III of the Chapter.

NPDES - The Federal Water Pollution Control Act Amendments of 1972 (the Act) established a National Pollutant Discharge Elimination System (NPDES) permit program. Any person presently discharging wastewater to public waters is required to obtain an NPDES permit. Any person proposing a disposal system which will result in a wastewater discharge is required to apply for an NPDES permit at least 180 days before such discharge is to commence.

The Act also established a procedure whereby the EPA can delegate permit authority to those States that desire to administer the NPDES program. The State must demonstrate ability to conduct the program and must have adequate legal authority to enforce the permits. The DEQ is currently preparing a delegation request to the EPA for issuance of NPDES permits in Iowa.

Operation Permits - An operation permit is a legally enforceable document which specifies the type of waste water which may be discharged, as well as the allowable quantities, concentrations, and rates of discharge. As a minimum, the effluent limitations are equivalent to secondary treatment for municipalities or BPT for industries, but, more stringent limits may be required as needed to meet water quality standards.

The permits also contain self-monitoring and reporting provisions that require dischargers to monitor their effluents and report the results to the DEQ. The DEQ data processing system stores and reports the water quality and compliance schedule data in formats designed to point out violations and problem areas. Fiscal and personnel constraints limit the number of violations and problem areas that can be effectively pursued. Staff resources are, therefore, directed to those discharges which are determined to be of sufficient importance by the priority ranking formula.

Provisions of the State construction and operation permit program also require that certain agricultural operations also obtain a permit for wastewater disposal. This subject is discussed in Chapter VII. Industries which discharge their wastewater to municipal plants do not need an operation permit, but must follow certain pre-treatment standards as published by the EPA.

Operation permits are written for a maximum of five years, with renewal application required prior to expiration. A permit can be modified at any time if there is a violation of any terms or condition of the permit, a change in any condition that requires either a temporary or permanent reduction or elimination of the permitted discharge, or if it is found that the permit was obtained under any type of misrepresentation of fact.

Many dischargers are not currently treating their wastewaters to a sufficient degree to comply with the final effluent limitations of their permit. In these cases the permits are written with interim and final effluent limitations and legally enforceable compliance schedules. These compliance schedules usually specify a series of interim dates so as to assure steady progress on the remedial efforts.

Iowa water pollution control law provides for stiff penalties for violations of permits and other rules or standards. A large bulk of the DEQ compliance action work load is directed toward negotiating achievable timetables. Negotiations are aimed at identifying practical remedial measures. Legal enforcement actions follow only where negotiations are not effective.

Water Quality Management Deadlines

As already mentioned, this document will help to direct the water quality management strategies necessary to implement a remedial program needed to meet the goals of the Act. The Act and the DEQ specify several deadlines that must be met in the implementation of this management program. Several key dates which have been established both by the EPA and the DEQ for improving wastewater treatment to protect National and State water quality follow. These dates are used to establish implementation schedules for the remedial measures defined by this plan.

Date	Action
December 31, 1974	National Pollutant Discharge Elimination System permits issued.
June 30, 1975	Section 303(e) basin plans completed.
July 1, 1977	Secondary treatment required for all publicly-owned treatment works.
July 1, 1977	Best practicable waste treatment technology for all industrial discharges.

July 1, 1977	More stringent effluent limits to meet Iowa water quality standards.
July 1, 1983	Best practicable waste treatment technology for all publicly-owned treatment works.
July 1, 1983	Best available technology for all industrial discharges.
July 1, 1985	Zero pollutant discharge.

Construction Grants

If all point source dischargers are to meet the effluent limitations imposed by the waste load allocations, considerable monetary expenditures will be required on behalf of municipalities and industries. Industrial dischargers must provide their own waste treatment financing. The Federal Water Pollution Control Act Amendments of 1972, under Title II - "Grants for Construction of Treatment Works" provide for federal grants for publicly owned waste water treatment facilities. Municipalities may apply to the EPA through the DEQ for federal grants of 75% of eligible costs of their wastewater treatment works improvements. Municipalities must then provide from other sources, the remaining 25% of the cost. Eligible project costs include those for treatment, interceptors, and collection facilities. Collection facilities have been assigned lowest priority.

In the past, federal funds allocated to Iowa had been sufficient to cover the grant funding of all needed treatment facilities, however, during the past two years the needs have outgrown the availability of federal funds. Nationwide federal allotments for fiscal years 1974 and 1975 were $3 billion and $4 billion, respectively. Of the national allotment, Iowa's shares were $34.7 million and $39.3 million respectively. Current needs for the State for all eligible facilities excluding storm sewers, based on 1973 dollars is $989,584,000, as contained in the 1974 "Needs Survey" for the State of Iowa. These needs will continue to increase as better information is developed through the waste load allocations and basin planning processes. Inflation is also having a significant influence on treatment facility costs.

Priorities for Funding - To receive grant funding a municipality must proceed through certain requirements. The DEQ is responsible for establishing an orderly priority process for the administration and obligation of federal grant funds. All municipalities are placed on the state discharge inventory and assigned a discharge priority. Should a municipality have a need for improvement or construction of wastewater treatment facilities and apply for federal grant funds, it is then placed in the construction grant priority listing according to its discharge priority rank. The construction grant priority list is revised annually. After determination of the available federal grant money for the year, the annual project list can be established based upon the number of projects from the priority list that can be funded.

Prior to adoption of the annual "priority list" and "project list" for each fiscal year, a public hearing is held where interested persons may comment on the proposed lists. Following consideration of public hearing comments the final lists are prepared and approved by the Water Quality Commission and the EPA.

Types of Grants - Once a municipality has been placed upon the "project list" and has been found to be eligible for grant funding, a three-step grant process in initiated in accordance with Federal Regulations 40 CFR 35, promulgated by EPA to implement Title II of the Federal Act.

Step one, known as the facility plan, contains an evaluation of the water pollution control problem; explores a number of alternatives to eliminate the problem; conducts a cost-effectiveness study for each alternative; evaluates the environmental impact of each alternative; and finally, chooses the specific alternatives which seem to have the most environmental, economic, and social benefits. The facility plan must be submitted to the DEQ and the EPA for approval before the second step can be considered.

Step two covers the preparation of construction plans and specifications which are based on the alternative chosen in the facility plan. After approval of the plans and specifications by the DEQ and the EPA, step three, which is the actual construction of the required facilities, can be initiated. Grants are made to applicants for each of the three steps.

Before the facility planning (Step 1) process is begun, the DEQ will inform the applicant of the minimum quality of effluent which can be discharged to the receiving waters. The facility planning for a specific discharge is then directed at meeting these effluent limitations.

Priority System

Application of the waste load allocations and effluent limitations result in considerable needs to upgrade or expand existing wastewater treatment facilities. Although there is considerable expense involved to meet State and Federal water quality goals, the financial resources available each year for publicly owned facilities are limited. Not all needed projects can be funded at once. To solve this problem, a system of priorities has been established. This section describes a portion of the system proposed for use by the State of Iowa.

Stream Segment Priority Ranking - Each major river basin is first divided into various stream segments. Each stream segment consists of surface waters that have common hydrologic characteristics and natural, physical, chemical, and biological processes. In accordance with EPA guidelines, the stream segments must be classified either effluent limited (EL) or water quality limited (WQ).

Segment classification is a contributing factor in the determination of the segment ranking, discharger ranking, and compliance scheduling. The two segment types are described as follows:

1. An effluent limited (EL) segment is any segment where it is known that water quality is meeting and will continue to meet standards, or where there is adequate demonstration that standards will be met after application of secondary treatment or BPT to all point discharges to the segment.
2. A water quality limited (WQ) segment is any segment where it is known that water quality does not currently meet applicable standards and it is not expected that standards would be met even after application of secondary treatment or BPT to all point discharges to the segment.

All segments are next ranked in order of abatement priority. The ranking methodology attempts to take into account: (1) severity of pollution problems, (2) population affected, (3) need for preservation of high quality waters, and (4) national priorities.

Two major concepts were considered necessary and sufficient to distinguish any segment from other segments of the basin. These are: (1) the degree of usefulness of the segment, assuming water quality standards are met, and (2) the number of discharges required to meet effluent limitations in order to bring the segment into compliance with water quality standards. These concepts, thus, form the basis of the ranking methodology.

The specific formula used to calculate the total points for a segment is as follows:

$$\text{TOTAL SEGMENT POINTS} = (0.5 + A + B_c + B_w + C + BC + AES + POP) \times SQ$$

Where: A = 2 if the segment contains any designated class A waters and 0 otherwise.

B_c = 2 if the segment contains any designated class B cold waters and 0 otherwise.

B_w = 1 if the segment is designated as a class B warm waters and 0 otherwise.

C = 2 if the segment contains any designated class C waters and 0 otherwise.

BC = 1 if the segment is designated as being useful for either boating and/or canoeing and 0 otherwise.

AES = 1 if the segment is considered to include an area of significant aesthetic value and 0 otherwise.

$$POP = \begin{bmatrix} 2.0 \\ 1.5 \\ 1.0 \\ 0.5 \\ 0 \end{bmatrix} \text{ if } \begin{bmatrix} 30 \text{ or more} \\ 15 \text{ to } 30 \\ 5 \text{ to } 15 \\ 0.5 \text{ to } 5 \\ 0 \text{ to } 0.5 \end{bmatrix} \text{ thousand people reside}$$

within a 10 mile wide corridor adjacent to either side of the segment and at least one of the above terms (A, B_c, B_w, C, BC, or AES) is nonzero.

SQ = 6 if the segment is designated as water quality limited and more than four dischargers have a waste load allocation more stringent than secondary treatment.

SQ = 5 if the segment is designated as water quality limited and three or four dischargers in the segment have a waste load allocation more stringent than secondary treatment.

SQ = 4 if the segment is designated as water quality limited and one or two dischargers in the segment have a waste load allocation more stringent than secondary treatment.

SQ = 3 if the segment is designated as effluent limited with water quality standards violated.

SQ = 2.5 if the segment is designated as effluent limited with water quality standards met.

SQ = 2 if the pollution load to the segment at low flow is contributed equally by point and nonpoint sources.

SQ = 1 if the pollution load to the segment at low flow is predominantly from nonpoint sources.

The formula for total segment points contains two factors. The first factor allocates points for the degree of usefulness of the segment. It is felt that the population that uses, or would use, the waters of a segment are those most effected by any pollution problems in the segment and further, that this population increases in direct proportion to the potential usefulness of the segment.

The intent of allowing the points of terms A, B_C, B_W, C, BC, and AES, which designate specific water uses, is obvious.

The term POP is included to provide additional points when a segment has any of the above uses, since any usefulness is considered to be of somewhat greater value if a large population resides nearby. The constant term of .5 is included so the product of factors cannot be zero.

The second factor allocates a varying number of points based on whether the segment is designated as effluent limited or water quality limited. The highest level of points is given to segments which have a large number of discharges required to meet waste load allocations more stringent than secondary treatment or BPT to bring the segment into compliance with water quality standards. The scale of points for this factor basically gives an increasing amount of points in those areas where the greatest degree of point source pollution exists.

The total points for a segment are determined from a product of the points earned in each of the two factors. The formula was written in the form of a product so as to give low total points if either factor was low, and high points only if both factors are high. In this manner the formula weighs both the degree of usefulness of a segment and the severity of the pollution problem.

After the total points are determined for each segment in the basin, the segments are then ranked in decreasing order of points. The number one ranked segment is the segment receiving the most total points.

Following the segment ranking, abatement priority points are assigned to each segment. The abatement points are used as a factor in the municipal discharger ranking which is discussed later. The abatement priority points are determined as follows:

$$\begin{array}{l} \text{ABATEMENT} \\ \text{PRIORITY} \\ \text{POINTS} \end{array} = \begin{array}{l} \text{Total number of segments} \\ \text{in the basin} \end{array} + 1 - \text{Segment Rank}$$

The selected stream segments, for the Des Moines Basin are detailed in Chapter VI. Total segment points and segment rank, are also presented in the chapter.

Municipal Discharger Ranking Methodology - In compliance with 40 CFR 130.43, which states that significant municipal dischargers shall be ranked to be subsequently used in establishing priorities and output estimates for municipal facilities construction, the following discharger ranking methodology has been promulgated for the basin plans. This ranking methodology is also in collaboration with current EPA Basin Plan Guidelines (Part IV, para. c) which states that significant municipal dischargers should be ranked in order of abatement priority.

This methodology ranks the municipal discharges in order of significance based on the following criteria:

1. A means of indicating the relative magnitude of one discharger with respect to all other dischargers.

2. A means of accounting for the present effluent quality of the dischargers.
3. A means of indicating the relative magnitude of the discharger in comparison to the capacity of the stream segment at the point of discharge.
4. A means of indicating the relative magnitude of the discharger in comparison to the total waste load of all other dischargers to the stream segment.
5. A means of comparison of the relative merit of the stream segment, to which the municipality discharges, to other segments in the basin.

To incorporate these criteria in the ranking methodology, the following factors were considered and evaluated. It should be noted that the numbering of the factors corresponds to that of the preceding criteria.

1. Total pounds of BOD_5 and ammonia-N presently being discharged, using average reported flows.
2. Discharger's present BOD_5 and ammonia-N concentrations as reported through EQAP.
3. Discharger's present BOD_5 and ammonia-N waste load compared to the stream capacity.
4. Discharger's present BOD_5 and ammonia-N waste load compared to the total waste load from all dischargers to the stream segment.
5. Stream segment abatement priority points into which the municipality discharges.

Sufficient data is readily available to assess the degree of significance of a municipal discharger in terms of factors 1, 2, and 3. Likewise the stream segment abatement priority points, as indicated in factor 5, has previously been determined, however, the selection and manipulation of required data needed to comply with factor 4 is considerably more difficult due to the non-coincidental cause and effect nature of certain discharged pollutant materials. Thus a blending of factors 3 and 4 was deemed the most feasible alternative. This was accomplished by comparing the discharger's present BOD_5 and ammonia-N waste load to the respective values allowed for the discharger under its waste load allocation. This comparison was felt reasonable and justified since the calculations performed in determining waste load allocations take into account both stream capacities and other discharger's waste loads.

This methodology thus ranks a discharge with respect to its relative share of the waste load to the segment, as well as to the waste load the discharger contributes at its present degree of treatment. This rationale also takes into account population equivalency in lieu of just the contributing population, the relative overloading of the stream segment as determined by waste load allocations analysis, and the relative ranking of the stream segments as determined by the segment ranking methodology.

The specific formula used to rank dischargers is as follows:

$(A_1 + D_1)\ B_1 + (A_2 + D_2)\ B_2 + C =$ Discharger priority points.

The discharger ranking formula consists of four elements which attempt to incorporate the criteria described above. The four elements are as follows:

Element A: Present Effluent Discharge;

$$A_1 = \begin{bmatrix} 60 \\ 50 \\ 40 \\ 30 \\ 20 \\ 10 \\ 1 \end{bmatrix} \text{ if the present } BOD_5 = \begin{bmatrix} >60 \text{ mg/l} \\ 60\text{-}50.1 \\ 50\text{-}40.1 \\ 40\text{-}30.1 \\ 30\text{-}20.1 \\ 20\text{-}10.1 \\ 10\text{-}\ 0 \end{bmatrix}$$

$$A_2 = \begin{bmatrix} 60 \\ 50 \\ 40 \\ 30 \\ 20 \\ 10 \\ 1 \end{bmatrix} \text{ if the present } NH_3\text{-}N = \begin{bmatrix} >40 \text{ mg/l} \\ 40\text{-}30.1 \\ 30\text{-}23.1 \\ 23\text{-}15.1 \\ 15\text{-}\ 8.1 \\ 8\text{-}\ 2.1 \\ 2\text{-}\ 0 \end{bmatrix}$$

This element uses the present average reported BOD_5 and ammonia-N values as representative effluent values, (where possible).

Element B: Degree of stream overloading;

1. BOD Overloading Factor:

$$1 - \frac{\text{lbs. W.L.A.}}{\text{lbs. PRES}} = B_1$$

where: lbs. W.L.A. is the total lbs/day of BOD_5 allowed, as determined by the waste load allocation lb.

lbs. PRES is the average lbs/day of BOD_5 which is currently being discharged.

2. Ammonia-N Overloading Factor:

$$1 - \frac{\text{lbs. W.L.A.}}{\text{lbs. PRES}} = B_2$$

where: lbs. W.L.A. is the total lbs/day of NH_3-N allowed as determined by the waste load allocations.

lbs. PRES is the average lbs/day of NH_3-N which is currently being discharged.

Note: B_1 and B_2 are only allowed to vary from zero to 1.00 in this methodology. All other values are set equal to zero.

Element C: The segment abatement priority points are used for element C.

Element D: Total contributing lbs. of BOD_5 and NH_3-N:

$$D_1 = \begin{bmatrix}0\\1\\3\\5\\7\\9\\12\\14\\16\\18\\21\\25\end{bmatrix} \text{ if the present } BOD_5 = \begin{bmatrix}1.5 \text{ or less}\\1.5-\quad 3\\3-\quad 5\\5-\ 10\\10-\ 20\\20-\ 50\\50-100\\100-250\\250-750\\750-1500\\1500-2500\\2500 \text{ or more}\end{bmatrix} \text{ lbs.}$$

$$D_2 = \begin{bmatrix}0\\1\\3\\5\\7\\9\\12\\14\\16\\18\\21\\25\end{bmatrix} \text{ if the present } NH_3\text{-N} = \begin{bmatrix}.75 \text{ or less}\\.75-\quad 1.5\\1.5-\quad 2.5\\2.5-\quad 5\\5-\quad 10\\10-\quad 25\\25-\quad 50\\50-\ 125\\125-\ 375\\375-\ 750\\750-\ 1250\\1250 \text{ or more}\end{bmatrix} \text{ lbs.}$$

This element takes into account the actual waste load which the stream receives, instead of a representation of the actual population.

The relative position of each discharger is determined by its total points as calculated by the discharger ranking formula. The dischargers are finally ranked in decreasing order of discharger priority points. The ranking of municipal dischargers in the Des Moines Basin, as well as the priority points for each discharger, are presented in Chapter VI.

REFERENCES

1. Supporting Document For Iowa Water Quality Management Plans, Iowa Department of Environmental Quality, Water Quality Management Division, Des Moines, Iowa, 1976.

CHAPTER II - EXISTING DEVELOPMENT PATTERNS

POLITICAL SUBDIVISIONS

The Des Moines River Basin includes thirty-nine counties or parts thereof, as listed in Table II-1. Two hundred and seventeen incorporated communities are included within the basin boundaries. The 1970 population of these incorporated municipalities totaled 731,092. Sixty cities had populations greater than 1,000. Nineteen cities had populations in excess of 5,000. Only one city had a population over 50,000 which was Des Moines with a population over 200,000. Figures II-1, II-2, and II-3 show the incorporated municipalities in the basin and Table II-2 summarizes their 1970 populations.

POPULATION PROJECTION

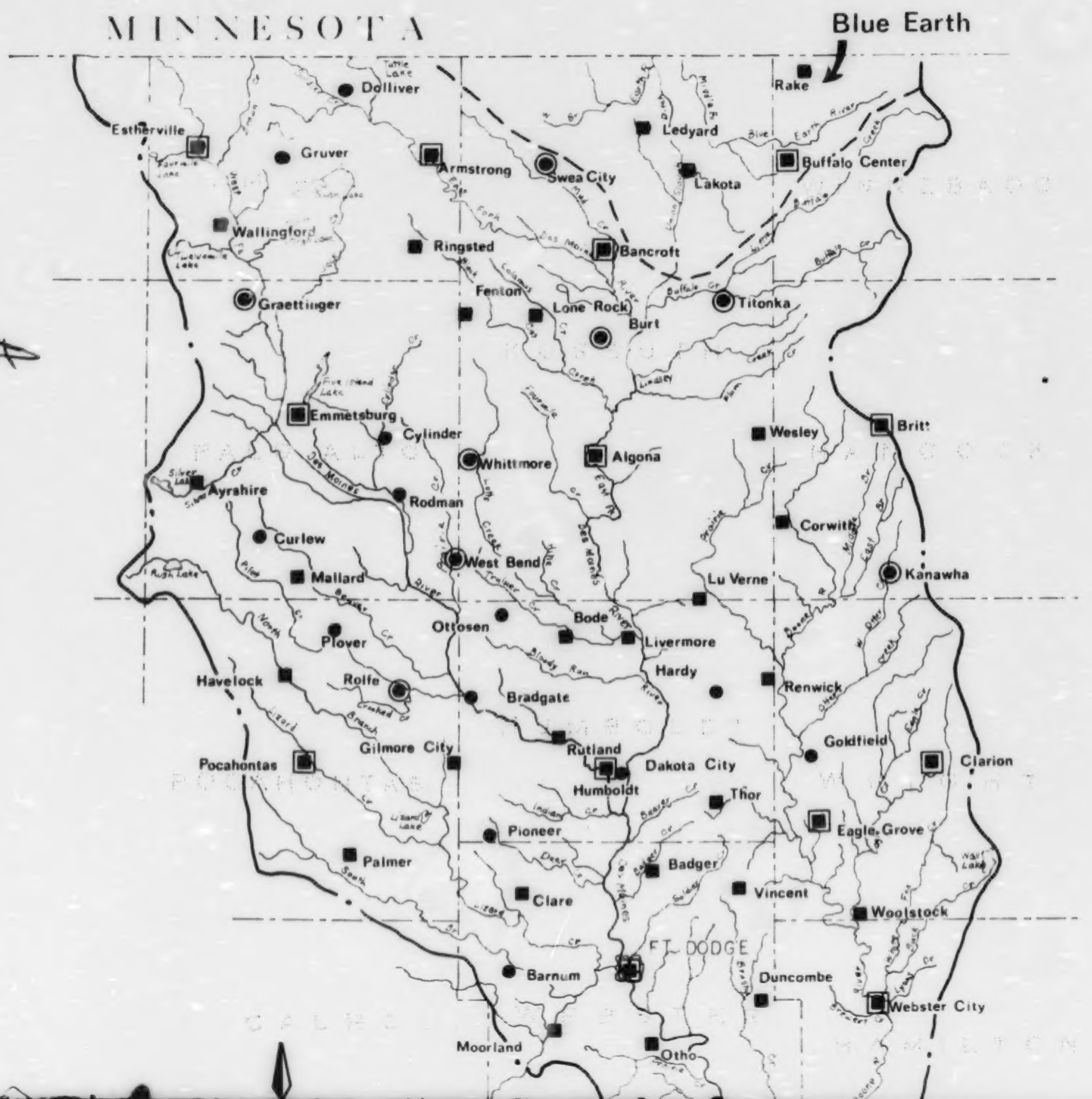
The Department of Environmental Quality has made population projections for cities within the Des Moines Basin for the year 1990, based on the projections of Taylor (1). For those individual municipal projections not estimated by Taylor, the 1990 population of the community was estimated by multiplying its 1970 population by the ratio of the projected 1990 county population to the 1970 county population. The population projections for 1990 that were used for this study are indicated in Table II-2.

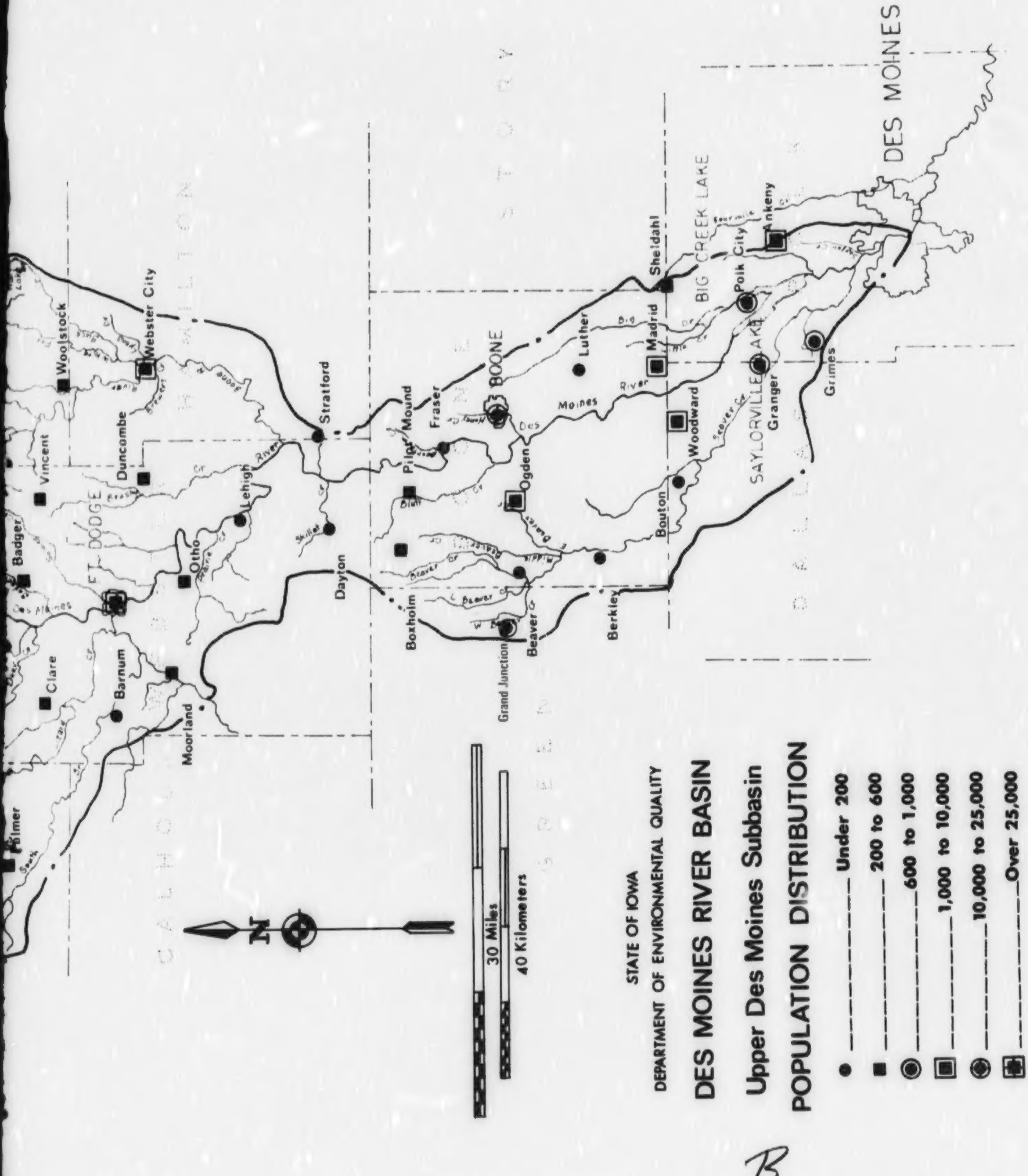
TABLE II-1

PORTIONS OF COUNTIES
THE DES MOINES RIVER BASIN

County	Percent Within Subbasin	County	Percent Within Subbasin
Upper Des Moines Subbasin			
County			
Boone	82	Humboldt	100
Calhoun	2	Kossuth	74
Clay	3	Pocahontas	67
Dallas	23	Polk	27
Emmet	96	Webster	76
Greene	8	Winnebago	26
Hamilton	32	Wright	65
Hancock	39		
Raccoon Subbasin			
County			
Audubon	5	Madison	1
Buena Vista	67	Palo Alto	1
Calhoun	98	Pocahontas	32
Carroll	80	Polk	13
Clay	1	Sac	49
Dallas	77	Webster	24
Greene	92		
Guthrie	75		
Lower Des Moines Subbasin			
County			
Adair	34	Madison	91
Appanoose	10	Mahaska	33
Clarke	66	Marion	86
Davis	38	Monroe	97
Guthrie	25	Polk	40
Jasper	11	Story	1
Jefferson	9	Van Buren	74
Lucas	67	Wapello	74
Lee	35	Warren	100

A

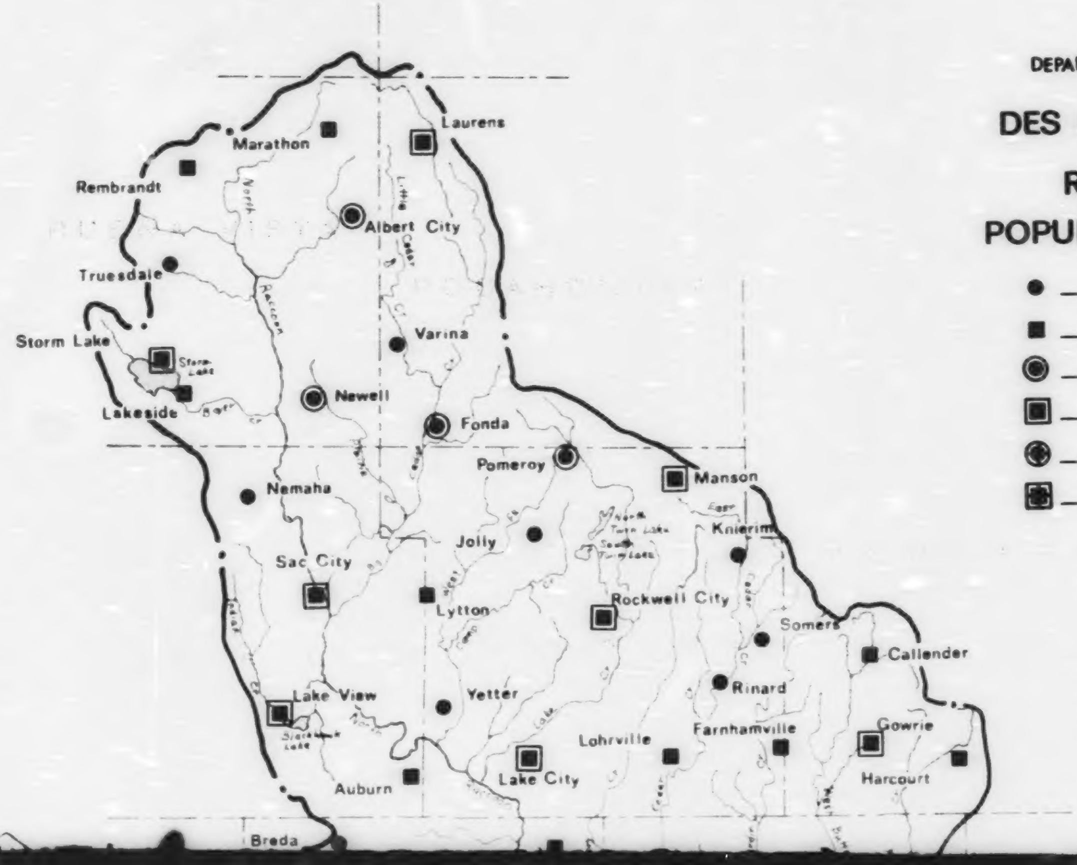

MINNESOTA
Blue Earth
Rake
Dolliver
Estherville
Gruver
Armstrong
Swea City
Ledyard
Lakota
Buffalo Center
Wallingford
Ringsted
Bancroft
Fenton
Lone Rock
Burt
Titonka
Graettinger
Emmetsburg
Cylinder
Whittmore
Algona
Wesley
Britt
Ayrshire
Rodman
Curlew
Corwith
West Bend
Mallard
Lu Verne
Kanawha
Ottosen
Bode
Livermore
Plover
Havelock
Rolfe
Hardy
Renwick
Bradgate
Goldfield
Rutland
Gilmore City
Pocahontas
Dakota City
Humboldt
Clarion
Thor
Eagle Grove
Pioneer
Palmer
Badger
Vincent
Clare
Woolstock
FT. DODGE
Barnum
Duncombe
Webster City
Moorland
Otho
Des Moines
Blue Earth River
Buffalo Cr
Lotts Creek
Boone R
Lizard
Beaver Cr


STATE OF IOWA
DEPARTMENT OF ENVIRONMENTAL QUALITY
DES MOINES RIVER BASIN
Upper Des Moines Subbasin
POPULATION DISTRIBUTION
● Under 200
■ 200 to 600
◉ 600 to 1,000
▣ 1,000 to 10,000
◉ 10,000 to 25,000
⊞ Over 25,000
N
30 Miles
40 Kilometers
Palmer
Clare
Barnum
Moorland
Badger
Vincent
Woolstock
Duncombe
Webster City
FT. DODGE
Otho
Lehigh
Stratford
Dayton
Boxholm
Pilot Mound
Fraser
BOONE
Ogden
Grand Junction
Beaver
Berkley
Luther
Madrid
Woodward
Bouton
Sheldahl
Polk City
Granger
Grimes
Ankeny
BIG CREEK LAKE
SAYLORVILLE LAKE
DES MOINES
CALHOUN
WEBSTER
HAMILTON
BOONE
STORY
GREENE
DALLAS
POLK
Des Moines River
Boone R
Lehigh River
Skillet Cr
Beaver Cr
L Beaver Cr
W Beaver Cr
Big Cr
Fourmile Cr

B

FIGURE II-1

A


N
30 Miles
40 Kilometers
Laurens
Marathon
Rembrandt
Albert City
Truesdale
Varina
Storm Lake
Storm Lake
Newell
Lakeside
Fonda
Pomeroy
Manson
Nemaha
Jolly
North Twin Lake
South Twin Lake
Knierim
Sac City
Lytton
Rockwell City
Somers
Callender
Rinard
Lake View
Yetter
Gowrie
Farnhamville
Lohrville
Auburn
Lake City
Harcourt
Breda
North Raccoon
Little Cedar Cr
Raccoon
Cedar Cr

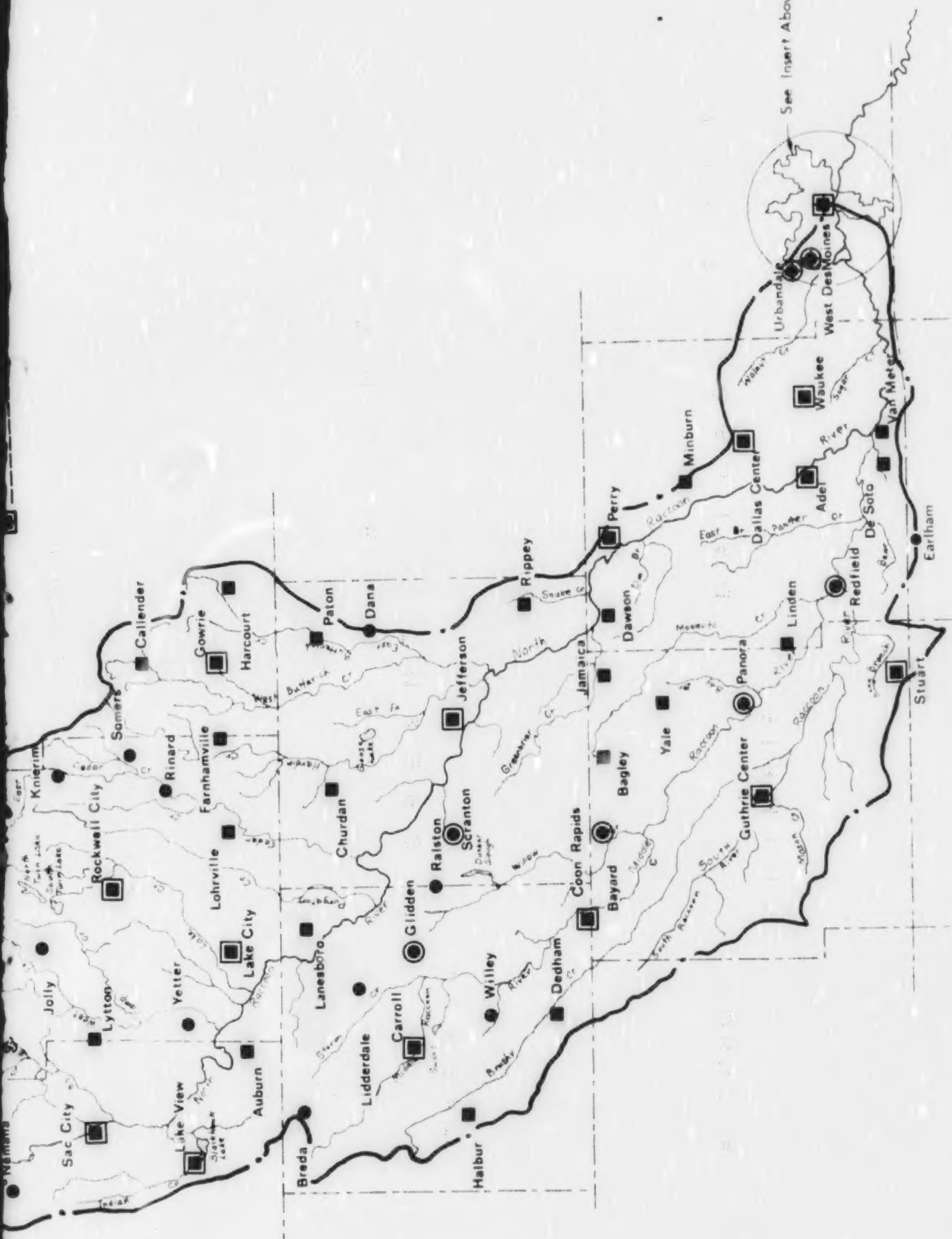
STATE OF IOWA
DEPARTMENT OF ENVIRONMENTAL QUALITY

DES MOINES RIVER BASIN

Raccoon Subbasin

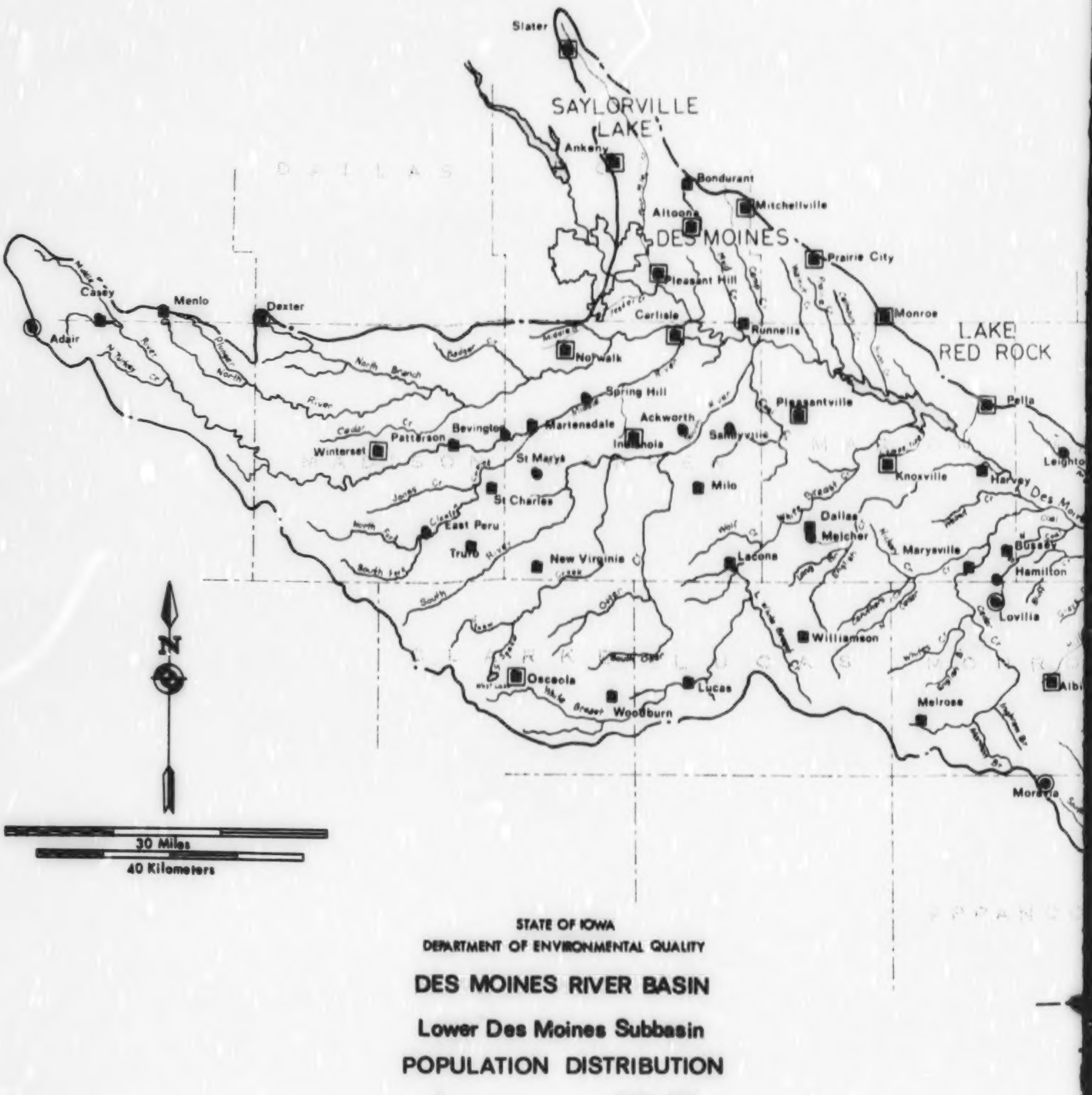
POPULATION DISTRIBUTION

● ____________ Under 200
■ ____________ 200 to 600
◉ ____________ 600 to 1,000
▣ ____________ 1,000 to 10,000
⊕ ____________ 10,000 to 25,000
⊞ ____________ Over 25,000


See Insert Above
Urbandale
West Des Moines
Waukee
Van Meter
Minburn
Dallas Center
Adel
De Soto
Earlham
Perry
Raccoon
River
East Br. Panther Cr.
Rippey
Dana
Paton
Harcourt
Gowrie
Callender
Somers
Knierim
Rockwell City
Rinard
Farnhamville
Lohrville
Churdan
Jefferson
North
Jamaica
Dawson
Linden
Redfield
Stuart
Panora
Yale
Bagley
Guthrie Center
Coon Rapids
Bayard
Scranton
Ralston
Glidden
Lanesboro
Lake City
Yetter
Lytton
Jolly
Sac City
Lake View
Auburn
Breda
Carroll
Lidderdale
Willey
Dedham
Halbur
South Raccoon
Middle Raccoon

B

FIGURE II-2



Slater
SAYLORVILLE LAKE
Ankeny
DALLAS
Bondurant
Mitchellville
Altoona
DES MOINES
Prairie City
Pleasant Hill
Casey
Menlo
Dexter
Adair
Carlisle
Runnells
Monroe
LAKE RED ROCK
Norwalk
Spring Hill
Pleasantville
Pella
Bevington
Martensdale
Ackworth
Sandyville
Winterset
Patterson
Indianola
St Marys
Knoxville
Harvey
Leighton
Milo
St Charles
MADISON
WARREN
MARION
East Peru
Dallas
Melcher
Truro
New Virginia
Lacona
Maryville
Bussey
Hamilton
Lovilia
Williamson
CLARKE
LUCAS
MONROE
Osceola
Lucas
Woodburn
Melrose
Moravia
APPANOOSE
N
30 Miles
40 Kilometers
North River
Middle River
South River
Badger Cr
Cedar Cr
Jones Cr
Clanton Cr
North Fork
South Fork
White Breast
Whitebreast Cr
Wolf Cr
English Cr
Cedar Cr
Otter Cr
South Otter
White Breast
Walnut Cr
Middle Cr
Camp Cr
Four Mile Cr
Des Moines River

STATE OF IOWA

DEPARTMENT OF ENVIRONMENTAL QUALITY

DES MOINES RIVER BASIN

Lower Des Moines Subbasin

POPULATION DISTRIBUTION

● ____________ Under 200

■ ____________ 200 to 600

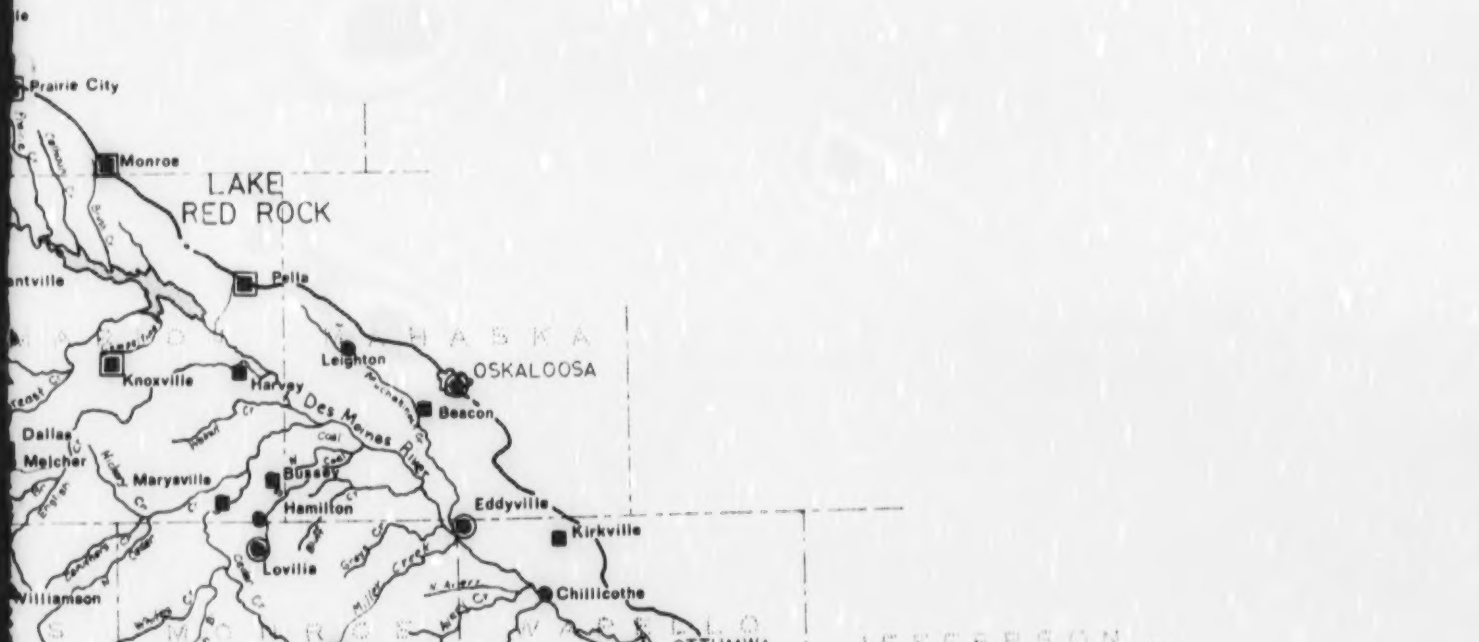
◉ ____________ 600 to 1,000

▣ ____________ 1,000 to 10,000

◉ ____________ 10,000 to 25,000

▣ ____________ Over 25,000

A


Prairie City
Monroe
LAKE RED ROCK
Pella
Leighton
OSKALOOSA
Beacon
Knoxville
Harvey
Des Moines River
Dallas
Melcher
Marysville
Bussey
Hamilton
Eddyville
Kirkville
Lovilia
Williamson
Chillicothe
OTTUMWA
JEFFERSON
Albia
Melrose
Blakesburg
Libertyville
Eldon
Moravia
Floris
DAVIS
VAN BUREN
APPANOOSE
Keosauqua
Bonaparte
Farmington
Donnellson
LEE
MISSOURI
KEOKUK
MAHASKA
MARION
MONROE
WAPELLO
Cedar Cr
Whitebreast Cr
Coal Cr
Avery Cr
Bear Creek
Village Cr
Soap Cr
Little Soap Cr
Brush Cr
South Soap Cr
Chequest Cr
South Chequest
Lick Cr
Indian Cr
Sugar Cr
Fox River
Des Moines River

B

FIGURE II-3

TABLE II-2

EXISTING AND PROJECTED POPULATIONS (AFTER TAYLOR (1))

TOWN	COUNTY	POP. 1970	POP. 1990
Ackworth	Warren	111	205
Adair	Adair	750	758
Adel	Dallas	2,418	3,318
Albert City	Buena Vista	683	723
Albia	Monroe	4,151	4,423
Algona	Kossuth	6,032	7,777
Allemen	Polk	183	236
Altoona	Polk	2,883	8,163
Ankeny	Polk	9,151	30,077
Arcadia	Carroll	414	451
Armstrong	Emmet	1,061	1,061
Auburn	Sac	329	347
Ayrshire	Palo Alto	243	243
Badger	Webster	465	540
Bagley	Guthrie	365	385
Bancroft	Kossuth	1,103	1,103
Barnum	Webster	147	171
Bayard	Guthrie	628	663
Beacon	Mahaska	431	443
Beaver	Boone	113	119
Berkley	Boone	56	59
Bevington	Madison	54	58
Blakesburg	Wapello	403	504
Bode	Humboldt	372	372
Bonaparte	Van Buren	547	562
Bondurant	Polk	462	605
Boone	Boone	12,468	15,071
Bouton	Dallas	160	219
Boxholm	Boone	242	256
Bradgate	Humboldt	130	130
Breda	Carroll	518	564
Britt	Hancock	2,069	2,263
Buffalo Center	Winnebago	1,118	1,148
Burt	Kossuth	608	608
Bussey	Marion	498	547
Callender	Webster	421	489
Carlisle	Warren	2,246	4,153
Carroll	Carroll	8,716	11,643
Casey	Guthrie	561	592
Chillicothe	Wapello	126	258
		63,436	101,307

TABLE II-2 CONTINUED

TOWN	COUNTY	POP. 1970	POP. 1990
Churdan	Greene	598	598
Clare	Webster	249	289
Clarion	Wright	2,972	3,189
Clive	Polk	3,005	7,066
Coon Rapids	Carroll	1,381	1,505
Corwith	Hancock	407	445
Cumming	Warren	189	286
Curlew	Palo Alto	95	95
Cylinder	Palo Alto	133	133
Dakota City	Humboldt	746	746
Dallas	Marion	438	481
Dallas Center	Dallas	1,128	1,547
Dana	Greene	118	118
Dawson	Dallas	232	318
Dayton	Webster	909	1,056
Dedham	Carroll	325	354
Des Moines	Polk	201,414	211,168
DeSoto	Dallas	572	600
Dexter	Dallas	652	894
Dolliver	Emmet	95	95
Donnellson	Lee	798	1,118
Duncombe	Webster	418	485
Eagle Grove	Wright	4,489	5,587
Earlham	Madison	974	1,045
East Peru	Madison	184	197
Eddyville	Wapello	970	1,212
Eldon	Wapello	1,319	1,649
Emmetsburg	Palo Alto	4,150	5,351
Estherville	Emmet	8,108	10,054
Farmington	Van Buren	800	823
Farnhamville	Calhoun	393	414
Fenton	Kossuth	403	403
Floris	Davis	145	145
Fonda	Pocahontas	980	1,034
Fort Dodge	Webster	31,263	40,134
Fraser	Boone	143	151
Gilmore City	Humboldt	766	766
Glidden	Carroll	964	1,050
Goldfield	Wright	722	722
Gowrie	Webster	1,225	1,423
Graettinger	Palo Alto	907	907

TABLE II-2 CONTINUED

TOWN	COUNTY	POP. 1970	POP. 1990
Grand Junction	Greene	967	967
Granger	Dallas	661	906
Grimes	Polk	902	1,182
Gruver	Emmet	135	135
Guthrie Center	Guthrie	1,834	1,935
Halbur	Carroll	235	256
Hamilton	Marion	186	204
Harcourt	Webster	305	354
Hardy	Humboldt	73	73
Hartford	Warren	582	881
Harvey	Marion	217	238
Havelock	Pocahontas	248	262
Humboldt	Humboldt	4,665	6,718
Indianola	Warren	8,976	14,486
Jamaica	Guthrie	271	286
Jefferson	Greene	4,735	5,926
Johnston	Polk	2,236	2,931
Jolley	Calhoun	112	118
Kanawha	Hancock	808	884
Keokuk	Lee	14,631	15,107
Keomah	Mahaska	58	62
Keosauqua	Van Buren	1,018	1,048
Kirkville	Wapello	222	278
Knierim	Calhoun	131	138
Knoxville	Marion	7,755	8,841
Lacona	Warren	424	784
Lake City	Calhoun	1,910	2,013
Lakeside	Buena Vista	353	373
Lake View	Sac	1,249	1,316
Lakota	Kossuth	385	385
Lanesboro	Carroll	203	221
Laurens	Pocahontas	1,792	1,891
Ledyard	Kossuth	240	240
Lehigh	Webster	739	858
Leighton	Mahaska	140	144
Libertyville	Jefferson	329	385
Lidderdale	Carroll	173	188
Linden	Dallas	278	381
Livermore	Humboldt	510	510
Lohrville	Calhoun	553	583

TABLE II-2 CONTINUED

TOWN	COUNTY	POP. 1970	POP. 1990
Lone Rock	Kossuth	166	166
Lovilia	Monroe	640	660
Lucas	Lucas	247	262
Luther	Boone	189	200
Luverne	Kossuth	380	380
Lytton	Sac	378	398
Madrid	Boone	2,448	2,587
Mallard	Palo Alto	384	384
Manson	Calhoun	1,993	2,100
Marathon	Buena Vista	447	473
Martensdale	Warren	306	556
Marysville	Marion	91	100
Melcher	Marion	913	1,003
Melrose	Monroe	192	198
Menlo	Guthrie	391	413
Milo	Warren	561	1,037
Minburn	Dallas	378	519
Mitchellville	Polk	1,341	1,758
Monroe	Jasper	1,389	1,684
Moorland	Webster	269	312
Moravia	Appanoose	699	707
Nemaha	Sac	117	123
Newell	Buena Vista	877	928
New Virginia	Warren	452	856
Norwalk	Warren	1,745	3,227
Ogden	Boone	1,661	1,755
Osceola	Clarke	3,124	3,462
Oskaloosa	Mahaska	11,224	12,575
Otho	Webster	581	675
Ottosen	Humboldt	93	93
Ottumwa	Wapello	29,610	29,759
Palmer	Pocahontas	264	278
Panora	Guthrie	982	1,036
Paton	Greene	329	329
Patterson	Madison	120	129
Pella	Marion	6,784	11,001
Perry	Dallas	6,906	9,074
Pilot Mound	Boone	214	226
Pioneer	Humboldt	56	56
Pleasant Hill	Polk	1,535	2,012

TABLE II-2 CONTINUED

TOWN	COUNTY	POP. 1970	POP. 1990
Pleasantville	Marion	1,297	1,425
Plover	Pocahontas	129	136
Pocahontas	Pocahontas	2,338	2,467
Polk City	Polk	715	937
Pomeroy	Calhoun	765	806
Prairie City	Jasper	1,141	1,383
Rake	Winnebago	324	333
Ralston	Carroll	129	141
Redfield	Dallas	921	1,263
Rembrandt	Buena Vista	250	264
Renwick	Humboldt	429	429
Rinard	Calhoun	88	93
Ringsted	Emmet	509	509
Rippey	Greene	270	308
Rockwell City	Calhoun	2,396	2,525
Rodman	Palo Alto	104	104
Rolfe	Pocahontas	767	809
Runnells	Polk	354	464
Rutland	Humboldt	215	215
Sac City	Sac	3,268	3,445
St. Charles	Madison	443	475
St. Marys	Warren	105	194
Sandyville	Warren	89	165
Scranton	Greene	751	751
Sheldahl	Polk	285	367
Slater	Story	1,094	1,589
Somers	Calhoun	197	208
Spring Hill	Warren	131	242
Storm Lake	Buena Vista	8,591	11,620
Stratford	Webster	710	824
Stuart	Adair	1,354	1,367
Swea City	Kossuth	774	774
Thor	Humboldt	212	212
Titonka	Kossuth	599	671
Truesdale	Buena Vista	132	140
Truro	Madison	359	385
Urbandale	Polk	14,434	41,800
Van Meter	Dallas	464	636
Varina	Pocahontas	140	148
Vincent	Webster	204	237

TABLE II-2 CONTINUED

TOWN	COUNTY	POP. 1970	POP. 1990
Wallingford	Emmet	245	249
Waukee	Dallas	1,577	2,163
Webster City	Hamilton	8,488	9,793
Wesley	Kossuth	548	548
West Bend	Kossuth	865	931
West Des Moines	Polk	16,441	28,137
Whittemore	Kossuth	658	658
Willey	Carroll	72	78
Williamson	Lucas	216	229
Windsor Heights	Polk	6,303	9,060
Winterset	Madison	3,654	4,442
Woodburn	Clarke	186	201
Woodward	Dallas	1,010	1,385
Woolstock	Wright	222	222
Yale	Guthrie	301	318
Yetter	Calhoun	47	50

ECONOMICS

Information for this section, was obtained from the Upper Mississippi River Comprehensive Basin Study (2).

A brief economic profile for the Des Moines Basin is given in Table II-3.

Labor Force

The labor force is expected to increase by 60 percent between 1960 and 2000 - less than the national change projected for the same period. The percent of population in the labor force reflects a relatively high proportion of men and low proportion of women.

Personal Income

Personal per capita income is expected to increase at about the same rate as the national average. As higher wage industries replace agriculture per capita income is expected to move close to the national level by the year 2020. Total personal income is expected to be somewhat less than the national average between 1960 and 2020.

Employment

As shown in Table II-4, civilian employment in a selected area, detailed in Figure II-4, which includes a major portion of the Des Moines, Skunk and Iowa-Cedar River Basins, is expected to reverse the decline of the 1950-60 period. In the period from 1960 to 2020, civilian employment will more than double from 490 thousand to 1.1 million. This rate of increase is less than the projected national average.

TABLE II-3

ECONOMIC PROFILE OF THE DES MOINES RIVER BASIN (2)

Year	Population, (thousands) Total	Nonfarm	Farm	Personal Income Total Income 1960 Dollars(Million)	Per Capita Income Dollars
1960	845	653	192	1,786	2,114
1980	1,112	971	141	4,130	3,713
2000	1,472	1,363	109	9,212	6,258
2020	1,946	1,850	96	19,026	9,777

Employment, (thousands)

Year	Total	Noncommodity Producing[a]	Commodity Producing[b]	Manufacturing Commodities	Nonmanufacturing Commodities
1960	303	196	107	47	60
1980	404	301	103	51	52
2000	530	432	98	57	41
2020	699	601	98	64	34

Employment for Selected Manufacturing Industries by SIC[d], (thousands)

Year	20 Food	28 Chem	29 Petrol Prod	32 Stone Clay, Glass	33 Primary Metals	34, 35 Fabr Met & Nonelec Mach	Total
1960	12	1	(c)	4	1	12	30
1980	12	1	(c)	4	1	14	32
2000	12	1	(c)	5	1	16	35

Output (Value Added) for Selected Manufacturing Industries by SIC, million 1960 dollars

Year	20 Food	28 Chem	291 Petrol Ref	324 Hyd Cemt	33 Primary Metals	34, 35 Fabr Met & Nonelec Mach	Total
1960	136	23	-	11	12	122	304
1980	299	65	-	36	20	251	671

---

[a] Noncommodity group includes the following SIC categories: 15-17 Construction; 40-49 Transportation, Communications, and Public Utilities; 50 Wholesale Trade; 52-59 Retail Trade; 60-67 Finance, Insurance, and Real Estate; 70-89 Services; and 91-93 Government.

[b] Commodity group includes SIC categories: 01-09 Agriculture; 10-14 Mining; 19 Ordnance; 20 Food; 21 Tobacco; 22 Textiles; 23 Apparel; 24 Lumber; 25 Furniture; 26 Pulp and Paper; 27 Printing and Publishing; 28 Chemicals; 29 Petroleum Products; 30 Rubber and Plastics; 31 Leather Products; 32 Stone, Clay, and Glass; 33 Primary Metals; 34 Fabricated Metals; 35 Nonelectrical Machinery; 36 Electrical Equipment; 37 Transportation Equipment; 38 Instruments; and 39 Miscellaneous Manufacturing and Other Manufacturing.

[c] Less than 500 employees.

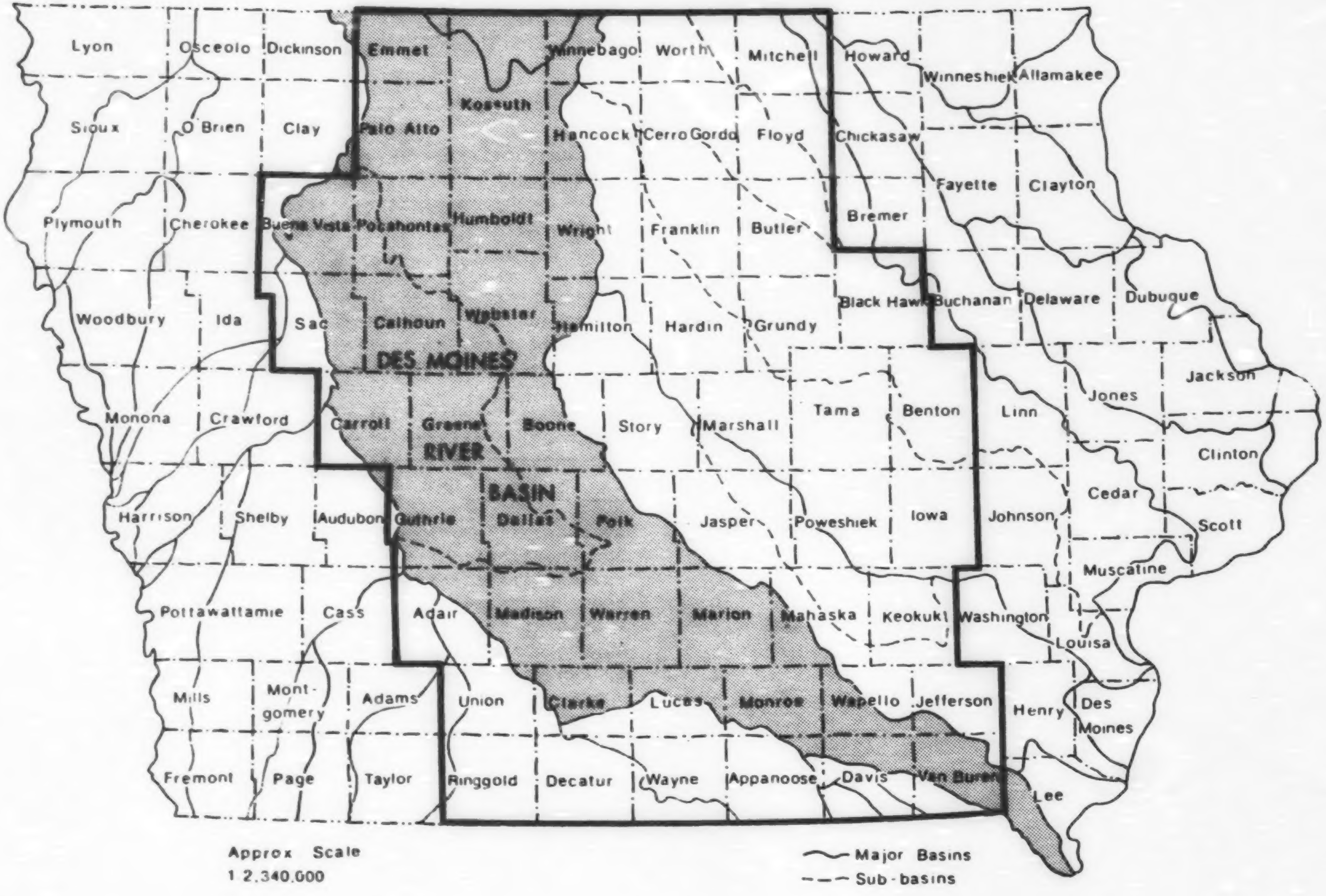
[d] Standard Industrial Classification.

TABLE II-4

SUMMARY ECONOMIC DATA (2) FOR SELECTED AREA SHOWN IN FIGURE II-4.

	Unit	1950	1960	1970	1980	1990	2000	2010	2020
Population	thousands	1,336	1,389	1,594	1,840	2,151	2,448	2,852	3,272
Students	thousands	19	21	41	54	61	69	-	-
Total, excluding students	thousands	1,317	1,368	1,553	1,786	2,090	2,379	-	-
Male	thousands	655	669	754	874	1,028	1,174	-	-
Female	thousands	663	699	799	913	1,062	1,206	-	-
Total, 15-69 yrs. excl. students	thousands	870	831	952	1,100	1,257	1,437	-	-
Male	thousands	429	402	402	538	619	710	-	-
Female	thousands	441	429	490	562	638	726	-	-
Total, excluding rural farm	thousands	933	1,052	1,298	1,580	1,928	2,256	2,672	3,105
Labor Force:									
Total	thousands	-	526	563	648	747	857	-	-
Male	thousands	-	369	393	452	522	600	-	-
Female	thousands	-	158	170	196	225	257	-	-
Labor Force Participation Rate:									
Total	percent	-	60.3	59.1	58.9	59.5	59.7	-	-
Male	percent	-	86.4	85.1	84.2	84.4	84.5	-	-
Female	percent	-	35.3	34.6	34.8	35.3	35.4	-	-
Employment (jobs):									
Total	thousands	492	490	569	656	755	863	1,001	1,148
Export	thousands	232	227	250	272	293	318	-	-
Residentiary	thousands	260	264	319	384	463	546	-	-
Total Employment (persons)	thousands	-	-	541	623	717	820	-	-
Unemployment Rate	percent	1.8	3.2	3.9	3.8	4.0	4.3	-	-
Personal Income:									
Total	mil. 1960 $	2,377	2,855	4,480	6,696	9,914	14,672	21,862	31,249
Wages and salaries	mil. 1960 $	1,727	1,903	2,984	4,466	6,622	9,830	-	-
Other income	mil. 1960 $	650	953	1,496	2,230	3,291	4,842	-	-
Per capita	1960 $	1,780	2,055	2,810	3,639	4,609	5,992	7,666	9,550
Wages and salaries per employee	1960 $	3,511	3,880	5,241	6,808	8,769	11,385	-	-

FIGURE II-4
DATA BASE AREA FOR EMPLOYMENT STATISTICS


Lyon
Osceola
Dickinson
Emmet
Winnebago
Worth
Mitchell
Howard
Winneshiek
Allamakee
Sioux
O'Brien
Clay
Palo Alto
Kossuth
Hancock
Cerro Gordo
Floyd
Chickasaw
Fayette
Clayton
Plymouth
Cherokee
Buena Vista
Pocahontas
Humboldt
Wright
Franklin
Butler
Bremer
Woodbury
Ida
Sac
Calhoun
Webster
Hamilton
Hardin
Grundy
Black Hawk
Buchanan
Delaware
Dubuque
DES MOINES
RIVER
BASIN
Monona
Crawford
Carroll
Greene
Boone
Story
Marshall
Tama
Benton
Linn
Jones
Jackson
Clinton
Harrison
Shelby
Audubon
Guthrie
Dallas
Polk
Jasper
Poweshiek
Iowa
Johnson
Cedar
Scott
Muscatine
Pottawattamie
Cass
Adair
Madison
Warren
Marion
Mahaska
Keokuk
Washington
Louisa
Mills
Mont-
gomery
Adams
Union
Clarke
Lucas
Monroe
Wapello
Jefferson
Henry
Des
Moines
Fremont
Page
Taylor
Ringgold
Decatur
Wayne
Appanoose
Davis
Van Buren
Lee
Approx Scale
1:2,340,000
Major Basins
Sub-basins

Employment in industries exporting their goods or services from the area decreased in the 1950's, but is expected to increase in future decades. Residentiary employment is expected to increase at about twice the rate of export employment in the basin between 1960 and 2000. By the turn of the century it is expected that there will be nearly two residentiary industry employees for every export industry worker. This is a substantial increase from the one to one ratio in 1950 and 1960.

Agriculture in 1950 was the largest employer in this area, engaging 60 percent more workers than its nearest rival, services. In the 1950-60 period, agricultural employment declined by one-fifth, bringing it to a level of employment about the same as services. Agricultural employment is projected to decline further, while the other industries increase. Agriculture is expected to rank second in employment in the 1970's, fifth by the year 2000, and sixth by the year 2020. Agricultural employment will decrease from nearly one-third to one-twentieth of the region's workers between 1950 and 2020.

Manufacturing is expected to retain about one-seventh of the area's workers through the projected period. In the 1950-60 period, manufacturers of nonelectric machinery replaced the food manufacturing industry as the major manufacturing employer. Electrical equipment, the third largest manufacturing employer, experienced a rapid increase in the 1950's, and by 1980 it is expected to be the largest manufacturing industry in the area. Electronics manufacturers in the Des Moines metropolitan area account for much of this employment. The one other industry employing a large and growing portion of manufacturing workers is the fabricated metals industry.

Mining employs few workers in the area and a significant increase is not expected. Retail trade employed about one-seventh of the total workers in the basin in 1960, and although the industry is expected to double its employment between 1960 and 2020, its share of regional employment will decline slightly. Services employment is expected to increase its 1960 level three and a half times by the year 2020, rising from 22 to 38 percent of total employment. Government, which is expected to increase by a factor of 6 during this interval, should rise from 4 to 11 percent of total employment. Finance, insurance, and real estate is also expected to increase its share of the basin's employment in the projected period, more than tripling its 1960 employment by 2020. Construction is expected to double in the same period. Wholesale trade and transportation-communications-public utilities are projected to grow slowly, the latter group having about the same number of employees in 2020 as in 1960. Both sectors are expected to represent an increasingly smaller share of the total employment force during the projected period.

RECREATIONAL ACTIVITIES

The Des Moines River Basin provides numerous water-related recreational activities. The following areas are suitable for recreational sites.

1. Hills with trees for nature observation, hiking, and camping.
2. Lakes or streams for swimming, boating, water-skiing, and fishing.
3. Flood plains and plateaus for organized sport activities.
4. A combination of the above for game habitats.

A common consideration of all available county and city plans was the concept of retaining land along rivers for conservancy belts. They are to be left in a natural state for recreational pursuits, such as hiking, and stream access.

From a recreational standpoint, water must be of sufficient quality to support the propagation of desirable forms of fish and wildlife. Iowa "Class B" warm water standards should be adequate to satisfy this requirement (see Chapter II, Supporting Document). In areas where human body contact with the water is permitted, "Class A" standards are required for public health reasons. Maintenance of either Class A or Class B standards are required to retain an aesthetically acceptable water condition.

Figures II-5, II-6, and II-7 show the locations of areas for boating activities in the Des Moines River Basin. In areas that allow power boats in excess of 10 horsepower, it is assumed that waterskiing and swimming would occur, and that Class A standards should apply even though they may not now be in effect. Total or partial body contact with water would probably occur in areas not specifically designated. For example, body contact would generally occur in the canoeing regions, however, only those areas designated as body contact area need to meet Class A standards.

Figures II-5, II-6, and II-7 also show the location of existing and proposed recreational sites in the river basin. Average daily peak attendance at parks was assumed to be 3 percent of the total yearly attendance. Total yearly attendance figures were obtained from state and county parks records, when available, or from estimates by park personnel. All wildlife areas were assumed to have less than 500 persons per peak day.

High user densities at specific recreation sites along the Des Moines River and at certain lakes can impart a high pollution load on the nearby groundwater and surface water unless wastes are satisfactorily handled. Although many of the lakes are at present lightly developed, intense development will increase pollution potential. Proper planning of recreational and wastewater treatment facilities would reduce the adverse impact upon water quality.

TABLE II-5

EXISTING AND PROPOSED RECREATION FACILITIES (3)

● UPPER DES MOINES RIVER BASIN

NO.	NAME OF AREA	OWNERSHIP	USAGE *	ACRES			MAJOR ACTIVITIES									
				TOTAL AREA	LAND AREA	WATER AREA	ARCHERY/GUN CLUB	BOATING	BOATING ACCESS	CAMPING	FISHING	GOLF COURSE	HIKING TRAILS	HUNTING	PICNICKING	SWIMMING
1	Del Rio Park	County	1	9												
2	Proposed Terrace Valley Park															
3	Bach Ranch	Private	1	159												
4	Iowa 4-H Camp	4-H	1	1008												
5	Proposed boat launch	Corps of Engr	1						●						●	
6	Boy Scout Camp	Boy Scouts	1	527												
7	Proposed boat launch	Corps of Engr	1						●						●	
8	Game farm	Private	1	415												
9	Campfire Girls Camp	Campfire Girls	1	92												
10	Lark Girls Ranch	Private	1	305												
11	Girl Scout Camp	Girl Scouts	1	229												
12	Holst Forest Preserve	State	1	313												
13	YMCA Camp	YMCA	1	350												
14	YWCA Camp	YWCA	1	138												
15	Morrison Church Camp	Church	1	238												
16	Lehigh Area	State	1	40				●	●	●	●					
17	Bells Mill Park	County	1	8						●	●				●	
18	Woodman Hollow Park	State	1	63						●	●			●		
19	Lizard Creek Area	State	1	102						●	●			●		
20	Woolstock Park	County	1	1										●		
21	Deer Creek Area	County	1	17												
22	Troy Park	County	1	1							●				●	
23	Humboldt Fish Hatchery	State	1	20												
24	Dakota City Access	State	1	6												
25	Des Moines River Access	County	1	1												
26	Center Township Park	County	1	6												
27	Bradgate Area	State	1	81							●			●		
28	Oakdale Park	County	1	20						●					●	

TABLE II-5 (CONT)

EXISTING AND PROPOSED RECREATION FACILITIES (3)

NO.	NAME OF AREA	OWNERSHIP	USAGE *	ACRES TOTAL AREA	ACRES LAND AREA	ACRES WATER AREA	ARCHERY/GUN CLUB	BOATING	BOATING ACCESS	CAMPING	FISHING	GOLF COURSE	HIKING TRAILS	HUNTING	PICNICKING	SWIMMING
	● UPPER DES MOINES RIVER BASIN															
29	Pilot Creek Park	County	1	13						●			●		●	
30	Feldman Park	County	1	3											●	
31	Proposed River Park	County		60-100												
32	Push Lake Park	State	1	522	62	460		●	●		●			●		
33	Wildlife area	County	1	23										●		
34	Steele Wildlife Area	County	1	41							●			●		
35	Proposed Boone Park	County		80												
36	Eddies Wildlife Refuge	County	1	40												
37	Silverlake Park	State	1	694	17	677		●	●		●			●		
38	Salton Park	County		15												
39	Proposed Pits Park	County														
40	Kearney Reserve	County	1	45												
41	Proposed Lindsey Creek Area	County		20-30												
42	Buffalo Creek Wildlife Area	State	1	380				●	●		●			●		
43	Grant Township Pk. Wildlife Area	County	1	33							●			●	●	
44	Union Slough Wildlife Refuge	Federal	1	2078												
45	12-Mile Lake Area	State	1	290	0	290								●		
46	Wolden Recreation Area	County		59												
47	Cunningham Slough Area	State	1	361										●		
48	Cheever Lake Wildlife Area	State	1	365	77	288								●		
49	Ryan Lake Area	State	1	366	0	366								●		
50	East Swan Lake Area	State	1	775	0	775										
51	East Des Moines River Access	State	1	45					●		●			●		
52	4-Mile Lake Area	State	1	237	24	213								●		
53	Eagle Lake Wildlife Area	State	1	278	11	266								●		
54	Grass Lake Area	State	1	171	0	171								●		
55	Prige Lake Area	State	1	137	0	137								●		

TABLE II-5 (CONT)

EXISTING AND PROPOSED RECREATION FACILITIES (3)

● UPPER DES MOINES RIVER BASIN

NO.	NAME OF AREA	OWNERSHIP	USAGE *	ACRES TOTAL AREA	ACRES LAND AREA	ACRES WATER AREA	ARCHERY/GUN CLUB	BOATING	BOATING ACCESS	CAMPING	FISHING	GOLF COURSE	HIKING TRAILS	HUNTING	PICNICKING	SWIMMING
56	Swag Lake (Burt Lake)	State		40		40					●					
57	Goose Lake	State		224	113	111					●			●		
58	Iowa Lake Slough	State		126	88	38										
59	Schwab Marsh	State		265	225	40								●		
60	State Line Marsh	State		147	147											
61	Seneca Access	State		36	36						●					
62	Kossuth County Park	County		120	67	53		●	●		●				●	
63	Michaelson's Slough	County		94	94									●		
64	Stinson Prairie	County		32	32									●		
65	Florence Park	County		52	52					●	●			●		
66	Grant Township Wildlife Area	County	1	33	12	21					●			●	●	
67-a	Saylorville Reservoir (4 Sites)	Corps of Engr.	4					●	●	●	●		●		●	
67-b		Corps of Engr.	4							●			●		●	●
67-c		Corps of Engr.	4							●	●		●		●	
67-d		Corps of Engr.	4										●		●	
68	Big Creek State Recreation Area	State/Federal	6	3,470		970		●	●	●	●		●	●	●	●
69	Jester Park	County	5	898				●		●	●	●	●		●	
70	Ledges Park	State	5	860				●	●	●	●		●		●	
71	Don Williams Park	County	4	598			●	●		●	●	●			●	●
72	Carlson Area	County	2	94												
73	Dolliver Memorial Park	State	3	572						●	●	●			●	
74	Brushy Creek Area	State	6	3002												
75	Briggs Woods Park	County	3	497					●	●	●	●				●
76	J.F.K. Memorial Park	County	3	395			●	●		●	●		●		●	●
77	Wall Lake Park	State	2	978	73	905								●		
78-a	Lizard Lake Area (3 Sites)	State	3	336	68	268		●		●	●			●	●	
78-b		State	-					●		●	●			●	●	
78-c		State	-					●		●	●			●	●	

TABLE II-5 (CONT)

EXISTING AND PROPOSED RECREATION FACILITIES (3)

●UPPER DES MOINES RIVER BASIN

NO.	NAME OF AREA	OWNERSHIP	USAGE *	ACRES			MAJOR ACTIVITIES									
				TOTAL AREA	LAND AREA	WATER AREA	ARCHERY/GUN CLUB	BOATING	BOATING ACCESS	CAMPING	FISHING	GOLF COURSE	HIKING TRAILS	HUNTING	PICNICKING	SWIMMING
79	F. A. Gotch Park	County	3	67						●	●				●	
80	Bradgate Access	County	2	109					●		●			●	●	
81-a	Lake Cornelia Park (5 Sites)	County	2	59				●		●	●				●	●
81-b	Eldridge Park	County	1	0.5											●	
81-c	Elm Lake	State	1	466	3	463									●	
81-d	Benton Wildlife Area	County	1	80												
81-e	Walker Slough	County	1	25										●		
82	Morse Lake Area	State	2	172	64	108		●	●		●			●		
83	Whitmore Park	County	2	41				●		●	●				●	●
84	A. A. Call Park	State	3	130						●			●		●	
85-a	5 Island Lake Area (2 Sites)	State	3	1110	165	945										
85-b	5 Island Wildlife Lake Area	State	-													
86	Ellsworth Park	County	3	130				●	●	●	●		●		●	
87	Ingham Lake	State	3	1002	626	376		●	●	●	●			●		
88	Proposed new county park	County	3	180-200												
89-a	Tuttle Lake (3 Sites)	State	1	989	8	981		●	●	●	●			●	●	
89-b	Tuttle Lake Park	County	2	19				●		●	●				●	
89-c	Tuttle Lake Marsh	State	1	173										●		

*APPROXIMATE PROBABLE USAGE

Visitors Per Average Peak Day	Usage Class
0-500	1
501-1,000	2
1,001-5,000	3
5,001-10,000	4
10,001-15,000	5
Over-15,000	6

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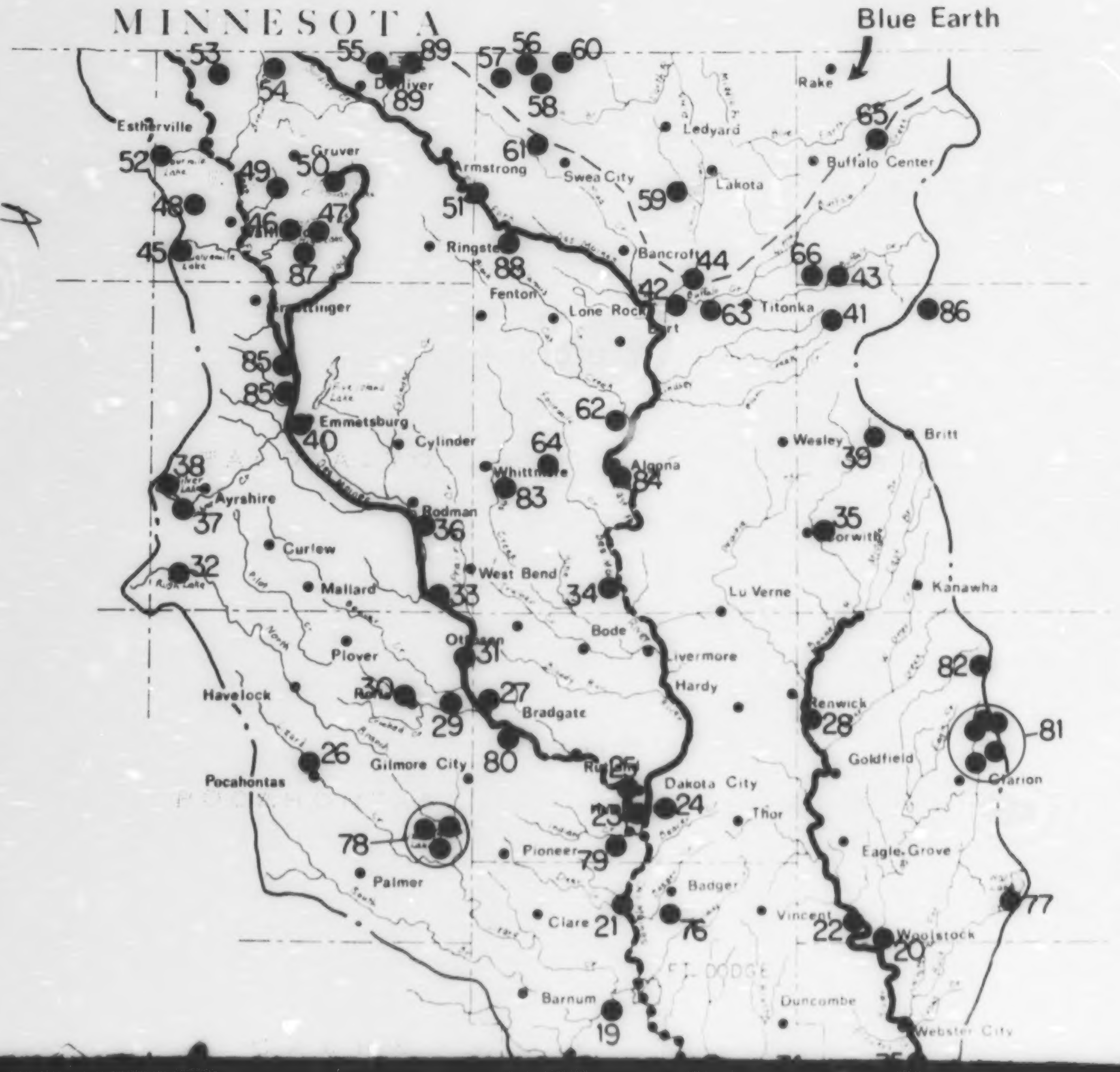
MINNESOTA
Blue Earth
Rake
Estherville
Gruver
Dolliver
Armstrong
Swea City
Ledyard
Lakota
Buffalo Center
Bancroft
Ringsted
Fenton
Lone Rock
Burt
Titonka
Emmetsburg
Cylinder
Whittemore
Algona
Wesley
Britt
Corwith
Kanawha
Ayrshire
Curlew
Mallard
Rodman
West Bend
Lu Verne
Bode
Livermore
Hardy
Ottosen
Plover
Havelock
Rolfe
Bradgate
Renwick
Goldfield
Clarion
Gilmore City
Pocahontas
Rutland
Dakota City
Thor
Pioneer
Eagle Grove
Palmer
Badger
Clare
Vincent
Woolstock
Barnum
Duncombe
Webster City
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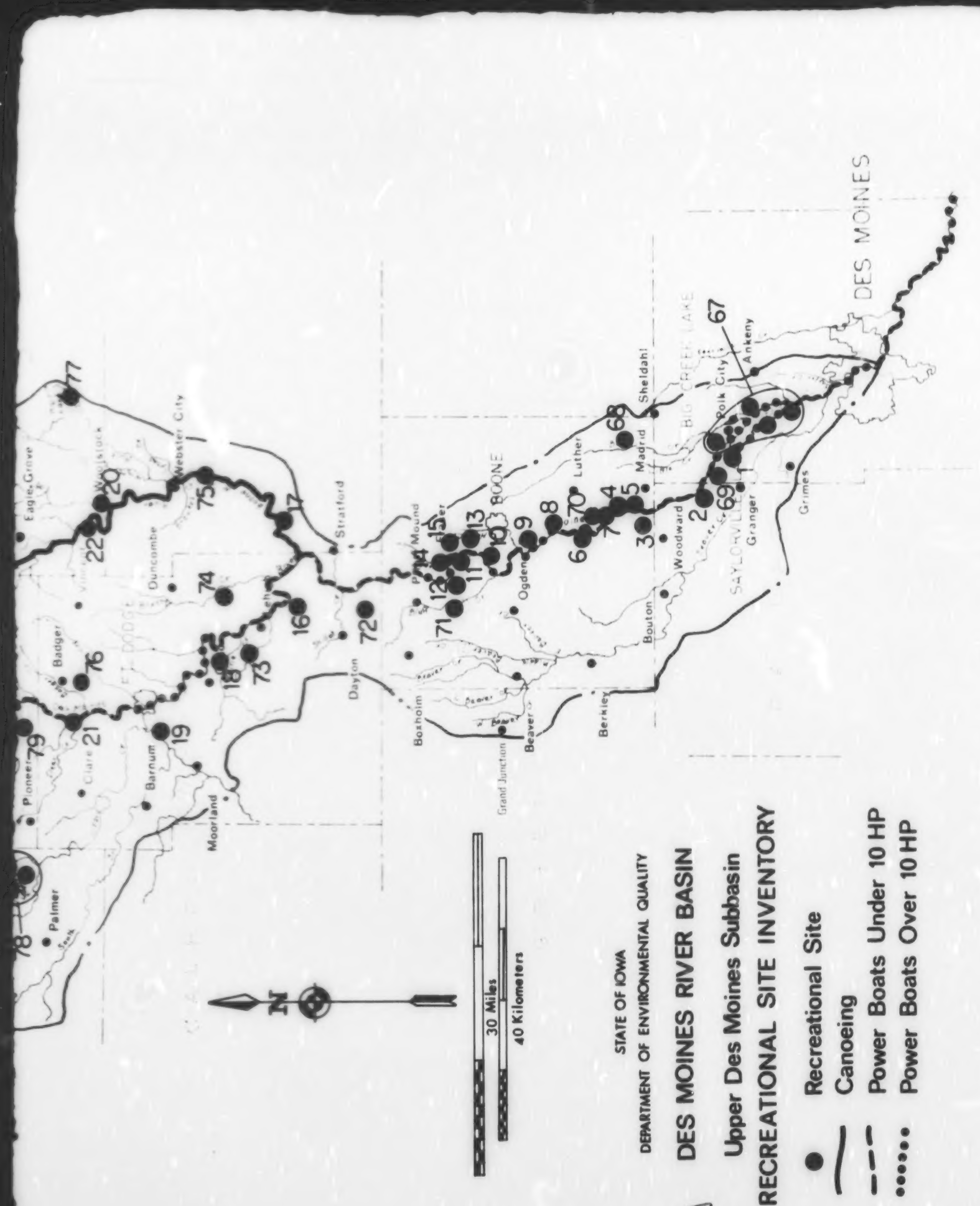
STATE OF IOWA
DEPARTMENT OF ENVIRONMENTAL QUALITY
DES MOINES RIVER BASIN
Upper Des Moines Subbasin
RECREATIONAL SITE INVENTORY
● Recreational Site
— Canoeing
— — Power Boats Under 10 HP
•••••• Power Boats Over 10 HP
30 Miles
40 Kilometers
N
B
DES MOINES
BIG CREEK LAKE
SAYLORVILLE
BOONE
FT. DODGE
Eagle Grove
Woolstock
Webster City
Duncombe
Vincent
Badger
Pioneer
Clare
Barnum
Moorland
Palmer
Stratford
Dayton
Boxholm
Pilot Mound
Grand Junction
Beaver
Ogden
Luther
Madrid
Sheldahl
Woodward
Bouton
Berkley
Polk City
Ankeny
Granger
Grimes
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FIGURE II-5

TABLE II-6

EXISTING AND PROPOSED RECREATION FACILITIES (3)

● RACCOON RIVER BASIN

NO.	NAME OF AREA	OWNERSHIP	USAGE *	ACRES TOTAL AREA	ACRES LAND AREA	ACRES WATER AREA	MAJOR ACTIVITIES ARCHERY/GUN CLUB	BOATING	BOATING ACCESS	CAMPING	FISHING	GOLF COURSE	HIKING TRAILS	HUNTING	PICNICKING	SWIMMING
1	Walnut Woods	State	3	260	260					●	●				●	
2	Raccoon River Access	State		5	5						●					
3	Izaak Walton League	Private	1	1	1						●				●	
4	Proposed Johnson Property	County	1	300						●			●		●	
5	Saylor Recreation Area	County	1	30											●	
6	Earlham Bridge	State		9	5	4		●	●		●			●		
7	Pleasant Valley	State		145	145						●			●		
8	Spring Valley	State		9	8	1										
9	Dallas County Area	State		132	132									●		
10	Forest Park & Museum	County		5	5										●	
11	South Raccoon River Access	County		33	33						●			●	●	
12	Sportsmens Park	County		40	40						●					
13	Timberline Ranch	Private		40	40					●						
14	Des Moines West KOA	Private		20	20					●						
15	Prairie Village	Private		10	10					●						
16	Trail Mark	Private		5	5					●						
17	Bays Branch	State		797	510	287		●	●	●	●			●	●	
18	Lakin Slough	State		300	135	165								●		
19	Lennon Mills	State		21	21					●	●			●	●	
20	McCord Pond	State		112	62	50										
21	Sheeder Prairie	State		25	25									●		
22	Springbrook State Park	State	3	721	691	30		●	●	●	●		●		●	●
23	Nation's Bridge Park	County		38	38					●	●		●		●	
24	Lake Panorama	Private		6500	5100	1400		●	●	●	●	●	●		●	●
25	Dunbar Slough	State		507	237	270								●		
26	Goose Lake	State		456		456								●		
27	McMahon Access	State		287	282	5					●			●		
28	Rippey Access	State		31	29	2		●	●		●			●		

TABLE II-6 (CONT)

EXISTING AND PROPOSED RECREATION FACILITIES (3)

● RACCOON RIVER BASIN (CONT.)

NO	NAME OF AREA	OWNERSHIP	USAGE *	ACRES			MAJOR ACTIVITIES									
				TOTAL AREA	LAND AREA	WATER AREA	ARCHERY/GUN CLUB	BOATING	BOATING ACCESS	CAMPING	FISHING	GOLF COURSE	HIKING TRAILS	HUNTING	PICNICKING	SWIMMING
29	Snake Creek Marsh	State		240	240										●	
30	Henderson Park	County		39	35	4		●	●	●	●		●		●	
31	Hyde Park	County		57	53	4		●	●	●	●				●	
32	Oak Hill Park	State		5	5					●					●	
33	Seven Hill Forest	County		80	80											
34	Squirrel Hollow Park	County		56	54	2		●	●		●		●		●	
35	Raccoon River Bible Conference	Private	1													
36	Artesian Lake	State		42	20	22					●			●		
37	Carroll County Access	State		40	38	2					●			●		
38	Swan Lake	State		508	378	130		●	●	●	●				●	●
39	Bennett Access Area	County		40	38	2								●		
40	Dickson Timber	County		155	155									●	●	
41	Hobbs Access	County		11	9	2				●	●			●	●	
42	Merritt Access	County		68	66	2				●	●			●	●	
43	Middle Raccoon River Access	County		92	92						●			●		
44	Rickey Access	County		3	3					●	●			●	●	
45	Riverside Park	County		4	4					●	●				●	
46	North Twin Lake	State		569		569			●			●			●	
47	North Twin Lake Access	State		5	5							●				
48	Rainbow Bend Access	State		19	17	2				●	●			●	●	
49	South Twin Lake	State		600		600								●		
50	Towhead Lake	State		193	193									●		
51	Camp Creek Area	County		8	8									●		
52	Featherstone Memorial Park	State		57	57			●	●	●	●				●	●
53	Game Preserve	County		4	4									●		
54	Game Refuge	County		7	7									●		
55	Hickory Grove Park	County		29	29									●	●	
56	Kelly Access	County		7	5	2				●	●			●	●	

TABLE II-6 (CONT)

EXISTING AND PROPOSED RECREATION FACILITIES (3)

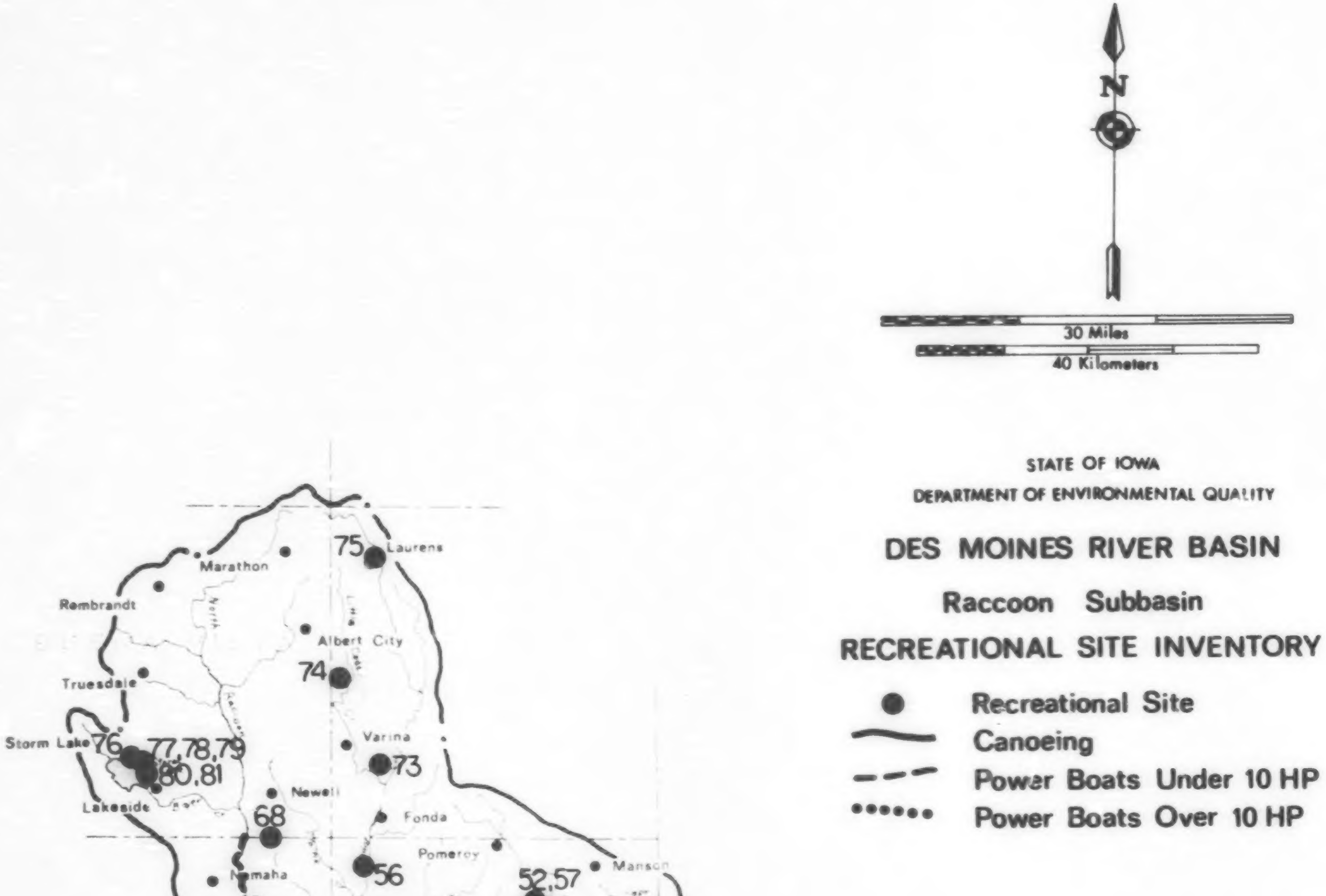
● RACCOON RIVER BASIN (CONT.)

NO	NAME OF AREA	OWNERSHIP	USAGE *	ACRES TOTAL AREA	ACRES LAND AREA	ACRES WATER AREA	MAJOR ACTIVITIES ARCHERY/GUN CLUB	BOATING	BOATING ACCESS	CAMPING	FISHING	GOLF COURSE	HIKING TRAILS	HUNTING	PICNICKING	SWIMMING
57	Lake's End Access	County		5	5			●	●		●				●	
58	University Forty Park	County		40	40					●	●				●	
59	Wildlife Area	County	1	1	1											
60	Wildlife Area	County	1	1	1									●		
61	Wildlife Refuge	County	1	1	1									●		
62	Wildlife Refuge	County	1	16	16											
63	Black Hawk Marsh	State		206	150	56										
64	Black Hawk Lake	State		957		957		●			●					
65	Sac City Access	State		23	21	2		●	●		●					
66	Lakeview Hatchery and Pits	State		156	156					●	●				●	
67	Black Hawk Lake State Park	State	4	267	267			●	●	●	●		●		●	●
68	Kiowa Marsh	State		40	40									●		
69	Tomahawk Marsh	State		39	39									●		
70	Grant Park	County		98	93	5				●	●				●	
71	Hagge Park	County		85	85						●				●	
72	Luback Forest	County		28	28											
73	Sunken Grove	State		371	371									●		
74	Little Clear Lake Park	County		15	15			●	●	●	●			●	●	
75	Northwest Recreation Area	County		16	16					●	●				●	
76	Bel Air Access	State		4	4			●	●		●					
77	Storm Lake Area	State		3097		3097		●			●			●		●
78	Storm Lake Shooting Area	State		276	12	264		●	●		●			●		
79	Storm Lake Reserve	State		12	12											
80	Caseno Bay Marina	State		14	14											
81	Assembly of God Bible Camp	Private	1													

*APPROXIMATE PROBABLE USAGE

Visitors Per Average Peak Day	Usage Class
0-500	1
501-1,000	2
1,001-5,000	3
5,001-10,000	4
10,001-15,000	5
Over 15,000	6

A



N
30 Miles
40 Kilometers
Recreational Site
Canoeing
Power Boats Under 10 HP
Power Boats Over 10 HP
Marathon
75
Laurens
Rembrandt
Albert City
74
Truesdale
Varina
Storm Lake
76
77,78,79
80,81
73
Newell
Lakeside
Fonda
68
Pomeroy
Manson
Nemaha
56
52,57
46,47
50
59
60
49
Sac City
65
72
71
Lytton
Rockwell City
Somers
69
51
61
Callender
63,66,67
64
Lake View
54
55
53
Rinard
70
Lohrville
62
Gowrie
Auburn
48
58
Harcourt
Breda
37

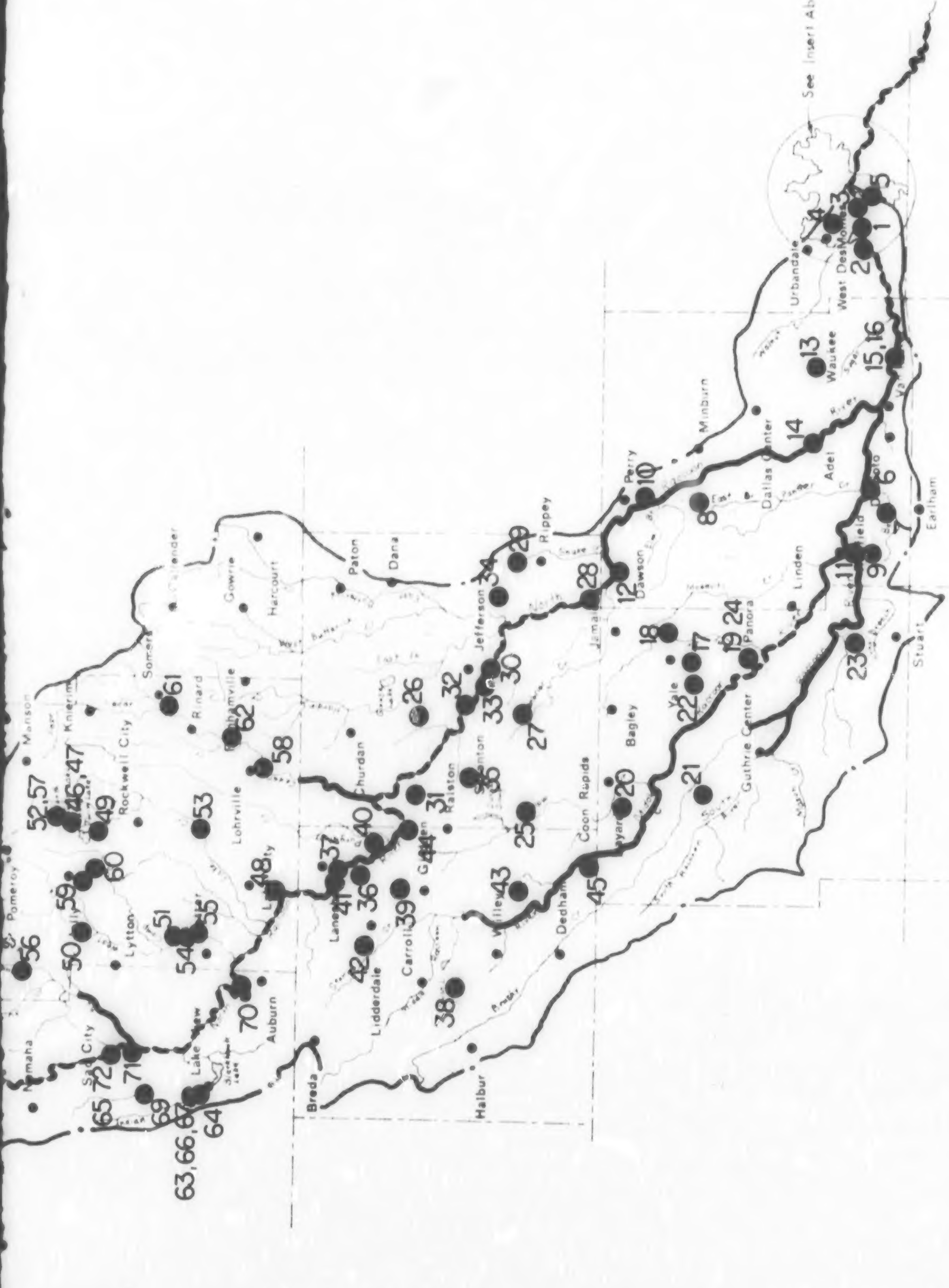
STATE OF IOWA

DEPARTMENT OF ENVIRONMENTAL QUALITY

DES MOINES RIVER BASIN

Raccoon Subbasin

RECREATIONAL SITE INVENTORY


See Insert Above
Urbandale
West Des Moines
Waukee
Minburn
Dallas Center
Adel
De Soto
Earlham
Perry
Rippey
Dawson
Redfield
Linden
Panora
Stuart
Jefferson
Jamaica
Yale
Guthrie Center
Bagley
Paton
Dana
Callender
Gowrie
Harcourt
Somers
Knierim
Manson
Rockwell City
Rinard
Farnhamville
Lohrville
Churdan
Ralston
Scranton
Coon Rapids
Bayard
Dedham
Willey
Glidden
Carroll
Lidderdale
Lanesboro
Lytton
Pomeroy
Lake View
Auburn
Sac City
Nemaha
Breda
Halbur
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B

FIGURE II-6

TABLE II-7

EXISTING AND PROPOSED RECREATION FACILITIES (3)

● LOWER DES MOINES RIVER BASIN

NO.	NAME OF AREA	OWNERSHIP	USAGE *	ACRES TOTAL AREA	ACRES LAND AREA	ACRES WATER AREA	MAJOR ACTIVITIES ARCHERY/GUN CLUB	BOATING	BOATING ACCESS	CAMPING	FISHING	GOLF COURSE	HIKING TRAILS	HUNTING	PICNICKING	SWIMMING
1	Lock & Dam #19	Federal						●			●					
2	Shimek State Forest Area	State		5878	5870	8				●	●		●	●	●	
3	Chatfield Park			80	80					●				●	●	
4	Croton Civil War Memorial Park	County		8	8						●					
5	Prices Creek	County		1	1						●					
6	Lake Koekuk Yacht Club	Private														
7	Southside Boat Club	Private														
8	Howards Boat Landing	Private														
9	Eldon Area	State		803	800	3					●			●		
10	Lake Wapello	State	4	1168	881	287		●	●	●	●		●		●	●
11	Stephens State Forest	State		646	646					●	●		●	●	●	
12	Drakeville Park	County		12	12					●	●					
13	Boy Scout Camp	Boy Scouts	1													
14	Cliffland Access	State		20	20			●	●	●	●			●	●	
15	Camp Arrowhead, YMCA	YMCA	1													
16	Izaak Walton League	Private														
17	YM & YWCA	YM & YWCA	1													
18	Stephens State Forest	State		1130	1130					●	●		●	●	●	
19	Moravia Recreation Area	County		1	1											
20	Cottonwood Pits	State		55	35	20		●	●	●	●			●		
21	Lahart Area	State		166	116	50		●	●	●	●			●		
22	Miami Lake	State		606	464	142		●	●	●	●		●	●		
23	Stephen State Forest	State		804	804					●	●		●	●	●	
24	Carmade Park	County		44	44											
25	Hull Area	State		378	348	30								●		
26	Oskaloosa YW & YMCA	YW & YMCA	1													
27	Red Rock Reservoir	Corp of Engr.		27514	19564	7950		●			●			●		
28	Red Rock Reservoir Easement	Private		29047	29047											

TABLE II-7 (CONT)

EXISTING AND PROPOSED RECREATION FACILITIES (3)

● LOWER DES MOINES RIVER BASIN (CONT.)

NO.	NAME OF AREA	OWNERSHIP	USAGE *	ACRES TOTAL AREA	ACRES LAND AREA	ACRES WATER AREA	ARCHERY/GUN CLUB	BOATING	BOATING ACCESS	CAMPING	FISHING	GOLF COURSE	HIKING TRAILS	HUNTING	PICNICKING	SWIMMING
29	Red Rock Wildlife Mgt. Area	Federal		16235	15235	1000		●			●			●		
30	Elk Rock Park	Federal		1271	1271			●	●		●		●		●	
31	White Breast Park	Federal		300	300											
32	Wallashuck Park	Federal		300	300											
33	S. Overlook	Federal		50	50											
34	North Overlook	Federal		50	50											
35	Tailwater Area	Federal		350	350											
36	Pella Area	State		276	266	10										
37	Roberts Creek County Park	Federal		1535	1235	300		●	●	●	●			●	●	●
38	Marion County Park	County		120	113	7				●	●				●	
39	Wilcox Wildlife Area	County	1	600	600									●	●	
40	Marion County Sportsmen Club	Private		20	15	2	●				●				●	
41	Izaak Walton League	Private														
42	Boy Scout Camp	Boy Scouts	1	40	40											
43	Stephens State Forest	State		4762	4751	11				●	●			●	●	
44	Red Haw Lake State Park	State	4	420	348	72			●	●	●		●		●	●
45	Williamson Pond	State		126	96	30			●	●	●			●	●	
46	Freedom Bible Camp	Church	1													
47	Stephens Forest	State		380	380					●	●			●	●	
48	Lake Ahquabi	State	6	774	644	130		●	●	●	●		●		●	●
49	Banner Area	State		224	184	40					●			●		
50	Hooper Area	State		323	319	4						●			●	
51	Izaak Walton Grounds	Private	1													
52	Four Mile Creek Greenbelt	County	1	61	61											
53	Mally's Park	County	1	37	36	1										
54	Thomas Mitchell Park	County		144	143	1				●					●	
55	Yeader Creek Area	County		454	234	220		●	●		●				●	
56	Proposed Johnson Property	County	1	300						●			●		●	

TABLE II-7 (CONT)

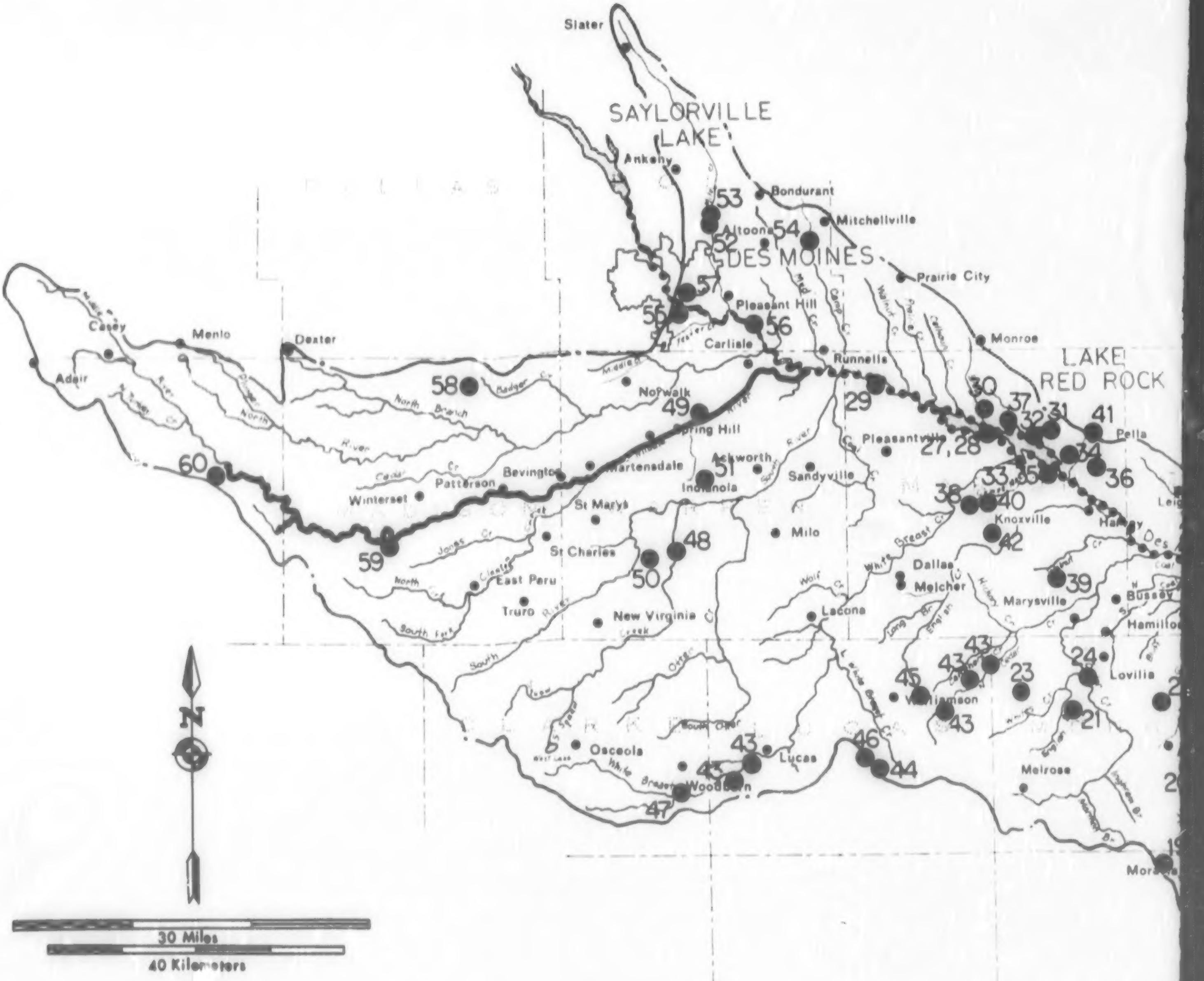
EXISTING AND PROPOSED RECREATION FACILITIES (3)

● LOWER DES MOINES RIVER BASIN (CONT.)

NO.	NAME OF AREA	OWNERSHIP	USAGE *	ACRES			MAJOR ACTIVITIES									
				TOTAL AREA	LAND AREA	WATER AREA	ARCHERY/GUN CLUB	BOATING	BOATING ACCESS	CAMPING	FISHING	GOLF COURSE	HIKING TRAILS	HUNTING	PICNICKING	SWIMMING
57	Proposed Saylor Recreation Area	County	1	30												
58	Badger Creek Watershed	State		615	615									●		
59	Pammel State Park	State	3	281	281					●	●		●		●	
60	Meadow Lake	State		320	273	47		●	●			●			●	
61	Lacey-Keosauqua	State		1366				●	●	●	●		●		●	●

*APPROXIMATE PROBABLE USAGE

Visitors Per Average Peak Day	Usage Class
0-500	1
501-1,000	2
1,001-5,000	3
5,001-10,000	4
10,001-15,000	5
Over 15,000	6


Slater
SAYLORVILLE LAKE
Ankeny
Bondurant
Mitchellville
Altoona
DES MOINES
Prairie City
Pleasant Hill
Carlisle
Runnells
Monroe
LAKE RED ROCK
Pella
Casey
Menlo
Dexter
Adair
Norwalk
Spring Hill
Ackworth
Pleasantville
Martensdale
Bevington
Patterson
Winterset
Indianola
Sandyville
St Marys
Milo
Knoxville
St Charles
East Peru
Truro
New Virginia
Dallas
Melcher
Marysville
Lacona
Bussey
Hamilton
Lovilia
Williamson
Osceola
Lucas
Woodburn
Melrose
Moravia
Harvey
North River
Middle River
South River
White Breast Cr
Cedar Cr
Des Moines River
53
54
52
57
55
56
58
49
60
51
59
48
50
29
30
37
32
31
41
27,28
33,35
34
36
38
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42
39
43
45
23
24
21
46
44
47
19
N
30 Miles
40 Kilometers

STATE OF IOWA
DEPARTMENT OF ENVIRONMENTAL QUALITY

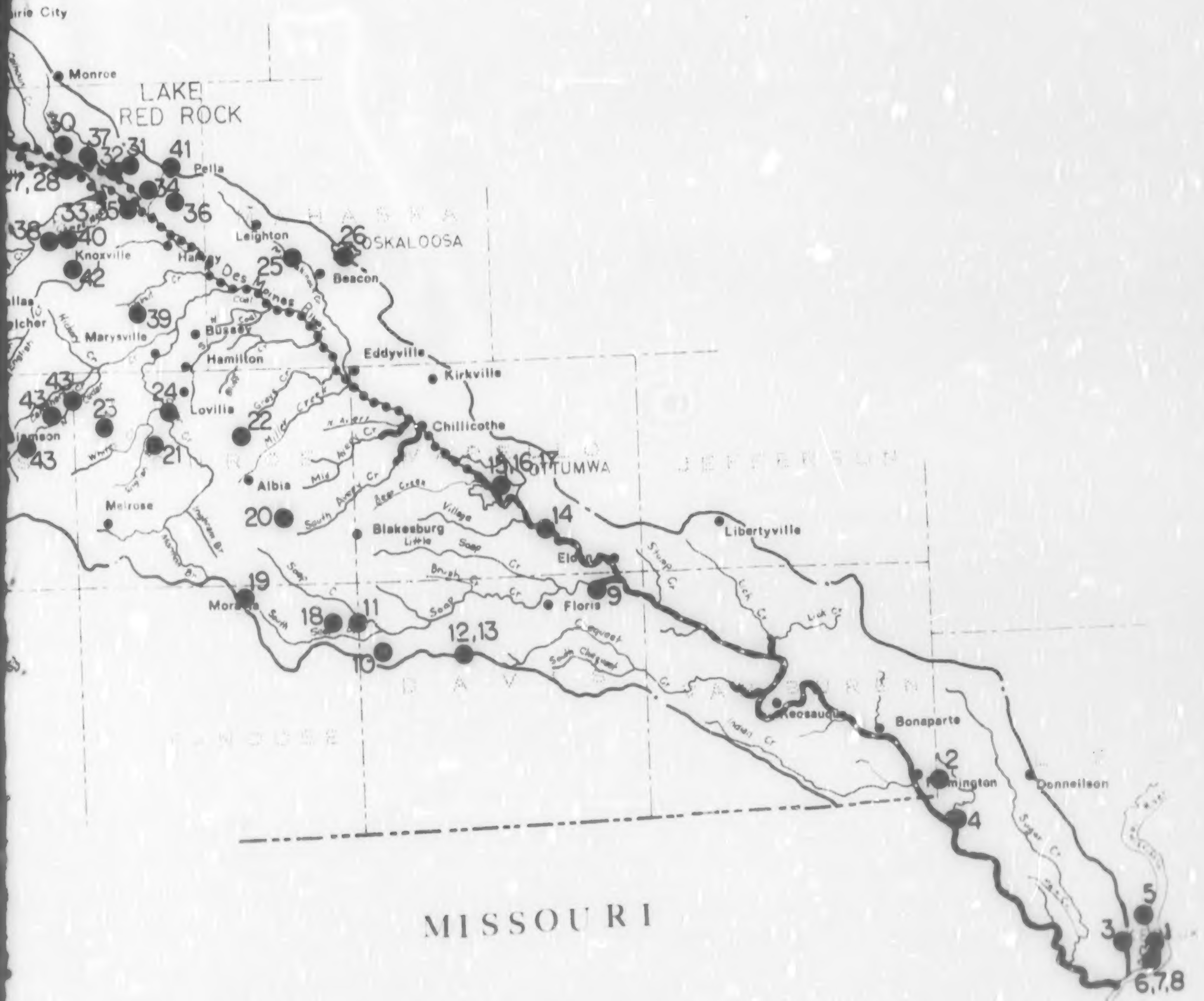
DES MOINES RIVER BASIN

Lower Des Moines Subbasin

RECREATIONAL SITE INVENTORY

● Recreational Site
— Canoeing
– – – Power Boats Under 10 HP
•••••• Power Boats Over 10 HP

A


Prairie City
Monroe
LAKE RED ROCK
Pella
MAHASKA
Leighton
OSKALOOSA
Beacon
Knoxville
Harvey
Des Moines River
Marysville
Bussey
Hamilton
Eddyville
Kirkville
Lovilia
Chillicothe
OTTUMWA
JEFFERSON
Albia
Melrose
South Avery Cr
Blakesburg
Libertyville
Eldon
Floris
Moravia
DAVIS
APPANOOSE
VAN BUREN
Keosauqua
Bonaparte
Farmington
Donnellson
Sugar Cr
MISSOURI
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6,7,8
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12,13
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15,16,17
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43

B

FIGURE II-7

REFERENCES

1. J. R. Taylor, Provisional Projections of the Population of Iowa Counties and Cities: 1975 to 1990, Iowa State Department of Health, June 1972.

2. Upper Mississippi River Comprehensive Basin Study, vol. VIII, appendix P: Economic Base Study and Projections, prepared by the Economic Advisory Committee, Upper Mississippi River Basin Coordinating Committee, 1970.

3. Outdoor Recreation in Iowa vol. V(b), Iowa Outdoor Recreation Guide, prepared by Planning and Coordination Section, Iowa Conservation Commission, July, 1972.

CHAPTER III - BASIN CHARACTERISTICS

The Des Moines River with its tributaries is the largest river in the State of Iowa, and the most westerly of the major rivers within the state which are directly tributary to the Mississippi River. Watersheds to the west of the Des Moines Basin drain into the Missouri River.

The Des Moines River rises in the glacial moraine area of Murray and Pipestone Counties, Minnesota, at an altitude of about 1,900 feet. It flows in a generally southeasterly direction for 535 miles and joins the Mississippi River just below Keokuk at an altitude of 476 feet (Fig. III-1). Numerous tributaries drain all or part of seven counties in Minnesota, 39 in Iowa, and one in Missouri. The total area drained is 14,540 square miles, of which 1,525 are in Minnesota, 12,925 are in Iowa, and 90 are in Missouri. The area drained in Iowa comprises 23 percent of the total area of the State. Table III-1 lists the area of watersheds drained by the river and its major tributaries.

The Blue Earth River has been included as part of the Des Moines River Basin to be consistent with Iowa Conservancy District boundaries.

The Blue Earth River drains parts of three Iowa counties: Worth, Winnebago and Kossuth. This area consists of the headwater portion of the basin. All streams flow in a general northward direction into Minnesota where they join the Blue Earth River, a tributary of the Minnesota River.

FIGURE III-1
DES MOINES RIVER BASIN(1)

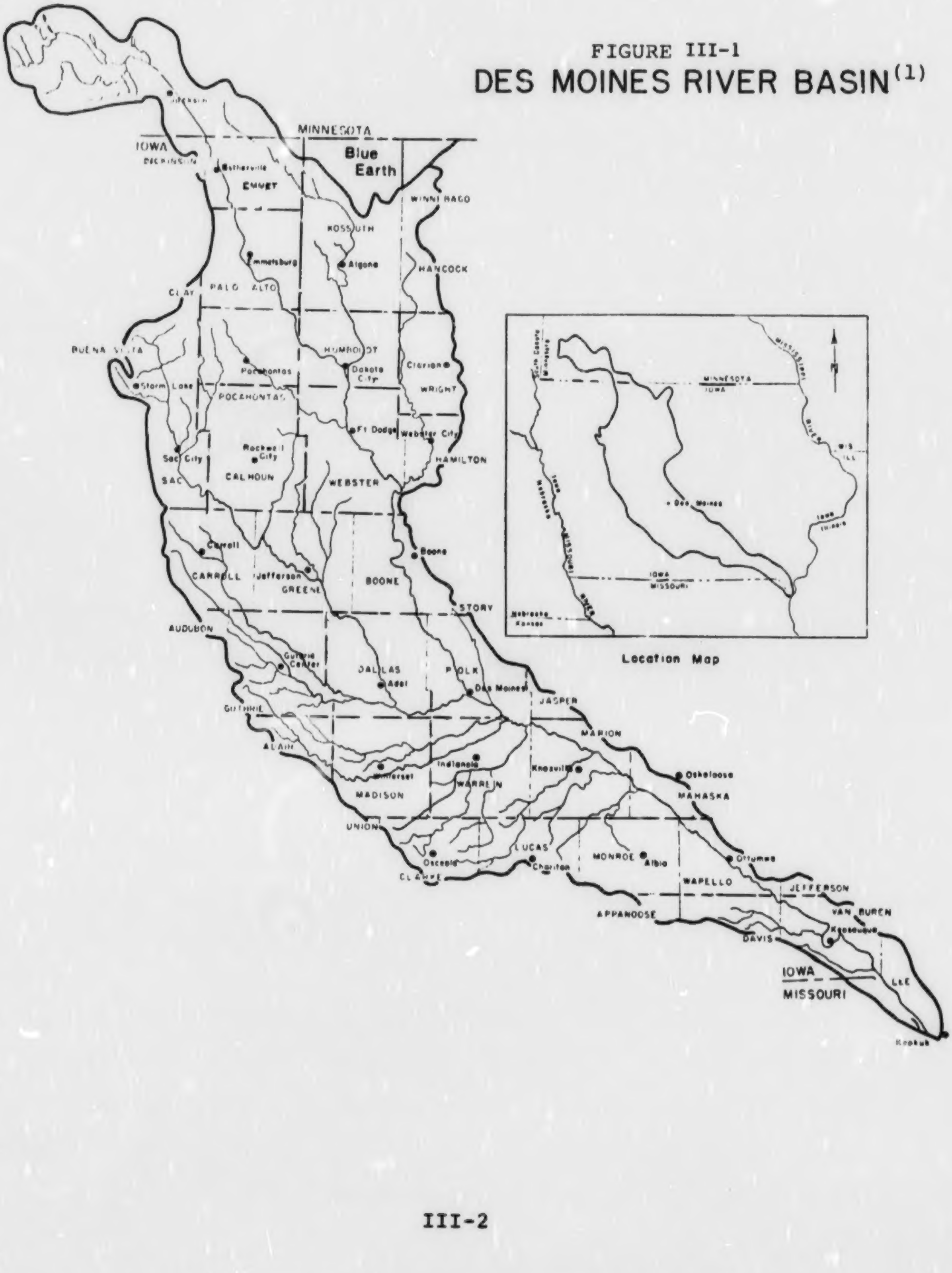

Jackson
MINNESOTA
IOWA
DICKINSON
Estherville
EMMET
Blue Earth
WINNEBAGO
KOSSUTH
Algona
Emmetsburg
HANCOCK
CLAY
PALO ALTO
BUENA VISTA
Pocahontas
HUMBOLDT
Dakota City
Clarion
Storm Lake
POCAHONTAS
WRIGHT
Ft Dodge
Webster City
Rockwell City
Sac City
SAC
CALHOUN
HAMILTON
WEBSTER
Carroll
Boone
CARROLL
Jefferson
GREENE
BOONE
STORY
AUDUBON
Guthrie Center
DALLAS
Adel
POLK
Des Moines
JASPER
GUTHRIE
MARION
ADAIR
Indianola
Knoxville
Oskaloosa
Winterset
WARREN
MADISON
MAHASKA
UNION
LUCAS
MONROE
Albia
Ottumwa
Osceola
Chariton
CLARKE
WAPELLO
JEFFERSON
APPANOOSE
VAN BUREN
DAVIS
Keosauqua
IOWA
MISSOURI
LEE
Keokuk
South Dakota
Minnesota
MINNESOTA
IOWA
Mississippi
River
WIS
ILL
Iowa
Nebraska
Des Moines
Iowa
Illinois
MISSOURI
River
IOWA
MISSOURI
Nebraska
Kansas
N
Location Map

TABLE III-1

DRAINAGE AREAS OF STREAMS IN THE DES MOINES RIVER BASIN (1)

Stream	Area (Square Miles)	Method of Determination
West Fork Des Moines River Basin		
West Fork Des Moines River, total area	2,308	b
East Fork Des Moines River Basin		
East Fork Des Moines River		
Above Mud Creek	358	b
Mud Creek	74	b
Lotts Creek	166	b
Total Area	1,315	b
Upper Des Moines River Basin		
Des Moines River below confluence of east and west forks	3,623	b
Lizard Creek	437	b
Boone River	906	c
Beaver Creek	372	b
Des Moines River at USGS gage, Des Moines	6,245	a
Raccoon River Basin		
Raccoon River above Cedar Creek	355	b
Cedar Creek	342	b
Lake Creek	129	b
Buttrick Creek	218	b
South Raccoon River above confluence with Middle Raccoon River	377	c
Middle Raccoon River	609	c
Raccoon River, total area	3,629	c
Lower Des Moines River Basin		
Des Moines River below Raccoon River at USGS gage 4855	9,879	a
Fourmile Creek	121	b
North River	400	d
Middle River	558	d
Camp Creek	41	b

TABLE III-1 CONTINUED

South River	590	d
Whitebreast Creek	430	d
Cedar Creek	423	d
Des Moines River at USGS gage at Ottumwa	13,374	a
Des Moines River, total area	14,467	d

Explanation of symbols:

a - Water-Supply Papers of the U.S. Geological Survey
b - U.S. Geological Survey base map of Iowa; scale 1:500,000
c - Corps of Engineers report on Des Moines River, Iowa, 1930; 71st Cong. 3rd Sess. House Doc. 682, table 6.
d - Based on area listed for gaging station located near mouth and published in Water-Supply Papers of the U.S. Geological Survey.

The Blue Earth River Basin has a drainage area of 3,106 square miles, of which 337 are in Iowa. Only four incorporated Iowa communities lie within the boundaries of the Blue Earth Basin. Of these, only one community has a comprehensive sewer system and treatment facility, and another has plans to construct a system.

The portion of the Blue Earth River Basin lying in Iowa amounts to only a small portion of the total basin drainage area and receives only one point source wastewater discharge. Since the Blue Earth River Basin lies mainly in Minnesota, no detailed analysis of the Iowa portion will be made in this report. Every effort will be made to coordinate with the Minnesota Pollution Control Agency in their planning for the basin.

LAKES AND IMPOUNDMENTS

Two major artificial impoundments are located on the Des Moines River. Red Rock Dam and Reservoir is located southeast of Des Moines in Marion County. Built as a major flood control project, the reservoir has a storage capacity of 1,830,000 acre-feet and regulates flow from an upstream drainage area of 12,323 square miles. The reservoir provides a conservation pool of 8,950 acres surface area for recreational purposes. The other major artificial impoundment, Saylorville Reservoir, is planned for completion in 1975. It will be located on the Des Moines River above Des Moines in West Central Polk County. It will have a storage capacity of 676,000 acre-feet and regulate flow from an upstream drainage area of 5,823 square miles. The reservoir is projected to provide a conservation pool with a 5,400 acrea surface area.

90 other smaller lakes, or impoundments, varying in size from approximately 1 to 1400 acres surface area, are also located in the Des Moines Basin. Of these, 31 are designated as Class A, 67 as Class B, and 10 as Class C (see Chapter III on water quality classifications). The lakes and impoundments in the basin are listed in Table III-2.

PHYSIOGRAPHIC FEATURES (1)

The physiographic features of the Des Moines River Basin are the result of an old erosional topography modified by several advances of continental glaciers within the past million years, and subsequent erosion.

TABLE III-2

DES MOINES RIVER BASIN
LAKES AND IMPOUNTMENTS

Lake or Impoundment	County	Surface Acres	Location*	Ownership	Type of Water	Surface Water Classification		
						A	B	C
Meadow Lake	Adair	40	31-76-17	State	OSI		X	
Don Williams Lake	Boone	160	32-85-27	C.C.B.	OSI	X	X	
Goldsmith	Buena Vista	35	35-93-19	Private	GP			
Pickerel Lake	Buena Vista	35	35-93-1	State	NL		X	
Storm Lake	Buena Vista	3,060	38-90-15	State	NL	X	X	
City Pond	Calhoun	1	32-87-36	City	OSI		X	
North Twin Lake	Calhoun	569	32-88-7	State	NL	X	X	
South Twin Lake	Calhoun	600	32-88-12	State	NL		X	
Artesian Lake	Carroll	30	33-85-27	State	OSI		X	
Swan Lake	Carroll	130	34-83-50	C.C.B.	NL	X	X	
East Lake (Osceola)	Clarke	15	25-72-16	City	OSI		X	
Liberty Acres	Clarke	7	24-73-8	C.C.B.	OSI		X	
West Lake (Osceola)	Clarke	175	26-72-13	City	OSI	X	X	X
Drakesville Ponds	Davis	4	14-69-4	City	OSI		X	
Eldon Game Area	Davis	4	12-70-9	State	FP		X	
Lake Wapello	Davis	287	15-70-34	State	OSI	X	X	X

TABLE III-2 (continued)

DES MOINES RIVER BASIN
LAKES AND IMPOUNDMENTS

Lake or Impoundment	County	Surface Acres	Location*	Ownership	Type of Water	Surface Water Classification		
						A	B	C
Christson Slough	Dickinson	158	35-100-13	State	NL			
Swan Lake	Dickinson	371	35-100-23	State	NL		X	
Cheever Lake	Emmet	282	34-99-20	State	NL			
Eagle Lake	Emmet	262	34-100-14	C.C.B.	NL			
Four-Mile Lake	Emmet	213	34-99-18	State	NL			
High Lake	Emmet	467	33-98-14	State	NL	X	X	
Ingham Lake	Emmet	421	33-98-12	State	NL	X	X	
Iowa Lake	Emmet	3-8	31-98-12	State	NL		X	
Tuttle Lake	Emmet	981	32-100-14	State	NL	X	X	
Twelve-Mile Lake	Emmet	290	34-98-21	State	NL		X	
West Swan Lake	Emmet	1,038	32-99-29	State	NL			
Anderson Park	Greene							
County Board Lake	Greene		31-83-4	C.C.B.	GP		X	
Dunbar Slough	Greene	200	32-83-29	State	OSI			
Goose Lake	Greene	456	31-84-1	State				
Spring Lake	Greene	49	30-84-25	C.C.B.	GP	X	X	

TABLE III-2 (continued)

DES MOINES RIVER BASIN
LAKES AND IMPOUNDMENTS

Lake or Impoundment	County	Surface Acres	Location*	Ownership	Type of Water	Surface Water Classification A	B	C
Bays Branch	Guthrie	270	30-80-22	State	OSI		X	
Diamondhead Lake	Guthrie	440	30-78-11	Private				
Lake Panorama	Guthrie	1,400	31-80-23	Private	OnSI			
McCord Pond	Guthrie	50	32-81-8	State	OSI			
Springbrook Lake	Guthrie	27	31-81-33	State	OSI	X	X	
East Twin Lake	Hancock	193	24-94-29	State	NL		X	
West Twin Lake	Hancock	109	24-94-30	State	NL		X	
Humboldt Impoundment	Humboldt			City	OnSI	X	X	
Burt Lake	Kossuth	46	30-100-9	State	NL		X	
Goose Lake	Kossuth	103	30-100-17	State	NL		X	
Lake Smith	Kossuth	53	29-96-36	C.C.B.	OSI	X	X	
Union Slough	Kossuth		28-97-21	Federal	OSI			
Whittemore Pit	Kossuth	14	30-95-9	C.C.B.	GP		X	
Chatfield Lake	Lee	30	5-65-2	C.C.B.	OSI		X	
Shimek Forest Ponds	Lee	22	7-67-31	State	OSI		X	
Ellis Lake	Lucas	110	21-72-27	City	OSI	X	X	X

TABLE III-2 (continued)

DES MOINES RIVER BASIN
LAKES AND IMPOUNDMENTS

Lake or Impoundment	County	Surface Acres	Location*	Ownership	Type of Water	Surface Water Classification		
						A	B	C
Morris Lake	Lucas	200	21-72-26	City	OSI	X	X	X
Red Haw Lake	Lucas	72	21-71-28	State	OSI	X	X	X
Stephens Farm Ponds	Lucas	7	23-72-22	State	OSI		X	
Stephens Farm Ponds	Lucas	10	23-72-28	State	OSI		X	
Williamson Pond	Lucas	25	21-73-27	State	OSI		X	
DeHal Lake	Marion	38	18-76-6	Private	OSI			
Knoxville Pond	Marion	7	20-75-12	C.C.B.	OSI		X	
Pleasantville Pond	Marion	3	21-76-15	City	OSI		X	
Red Rock Reservoir	Marion	8,950	18-76-30	Federal	OnSI	X	X	
Roberts Creek Lake	Marion	300	19-76-4	C.C.B.	OSI	X	X	
Tower Pond	Marion	7	18-76-31	C.C.B.	OSI		X	
Albia Reservoir	Monroe	80	17-72-9	City	OSI	X	X	X
Cottonwood Pits	Monroe	15	17-71-2	State	GP		X	
Lake Miami	Monroe	142	17-73-20	State & C.C.B.	OSI	X	X	
Curlew Pit	Palo Alto	2	32-94-5	Private	GP			
Five Island Lake	Palo Alto	945	32-96-18	State	NL	X	X	

TABLE III-2 (continued)

DES MOINES RIVER BASIN
LAKES AND IMPOUNDMENTS

Lake or Impoundment	County	Surface Acres	Location*	Ownership	Type of Water	Surface Water Classification		
						A	B	C
Silver Lake	Palo Alto	638	34-95-20	State	NL	X	X	
Fonda Reservoir	Pocahontas		34-90-22	City	OSI		X	
Lizard Lake	Pocahontas	268	34-91-22	State	NL		X	
Big Creek Reservoir	Polk	866	25-81-35	Federal	OSI	X	X	
City Ponds	Polk			City		X	X	
Dale Moffitt Reservoir	Polk	200	25-78-31	City	OSI	X	X	X
Easter Lake	Polk	228	23-78-19	C.C.B.	OSI	X	X	
Grays Lake	Polk	100	25-78-8	City	GP	X	X	X
Jester Park	Polk	3	25-80-10	C.C.B.	OSI	X	X	
Saylorville Reservoir	Polk			Federal	OnSI	X	X	
Arrowhead Lake	Sac	38	36-86-4	State	GP		X	
Black Hawk Lake	Sac	957	36-87-35	State	NL	X	X	
Hallet Pits	Sac		36-86-5	State	GP		X	
Indian Lake	Van Buren		8-67-2	County	OSI			
Lacey Keosauqua	Van Buren	30	10-68-2	State	OSI	X	X	X
Eldon Pond	Wapello	2	12-71-26	City	FP		X	

TABLE III-2 (continued)

DES MOINES RIVER BASIN
LAKES AND IMPOUNDMENTS

Lake or Impoundment	County	Surface Acres	Location*	Ownership	Type of Water	Surface Water Classification		
						A	B	C
Ottumwa Lagoon	Wapello	89	14-72-25	City	OSI		X	
Lake Ahquabi	Warren	140	24-75-14	State	OSI	X	X	X
Banner Pits	Warren	12	24-77-30	State	GP		X	
Hooper Area Pond	Warren	13	24-75-26	State	OSI		X	
Badger Lake	Webster	60	28-90-19	C.C.B.	OSI	X	X	
Dolliver Park Pond	Webster		28-89-15	State	GP			
Fort Dodge Pool	Webster		28-89-24	State	OnSI			
River Valley Reservoir	Webster		28-89-1	Private	OSI			
Clarion City Pond	Wright	10	23-91-6	City	GP			
Elm Lake	Wright	463	24-92-21	State	NL			
Lake Cornelia	Wright	273	24-92-16	State	NL	X	X	
Wall Lake	Wright	935	24-90-14	State	NL			

*Range-Township-Section

**Type of Water -

FP--- Farm Pond
GP--- Gravel Pit
NL--- Natural Lake
OnSI- On Stream Impoundment
OSI-- Off Stream Impoundment
CCB-- County Conservation Board

During the millions of years prior to glaciation, a complex and varying thickness of sediments, now represented mostly by sandstone, shale, limestone, and dolomite, were deposited chiefly by shallow seas that intermittently covered the area. The Iowa Geological Survey (1) has prepared a sketch of the nature and approximate thickness of these deposits and indicated the geologic age of each (Fig. III-2). Subsequent to Cretaceous time, the consolidated rocks were eroded and differentially uplifted one or more times so that the topography just prior to glaciation consisted of moderate slopes and a rather well-developed drainage system.

Four major intervals of glaciation, including some minor re-advances, separated by periods of erosion then modified the surface (Fig. III-3). Streams were diverted to new courses, some probably several times, and locally deep channels were cut into the bedrock surface. Deposits were laid down by the ice or by water and wind associated with each glaciation, and these were in turn more or less changed by subsequent periods of erosion and glaciation. The topography of the bedrock surface, the mantling effect of glacial deposits, and erosion during and subsequent to glaciation all contribute to the physiography of the Des Moines River Basin.

The basin is characterized by two topographic provinces which correspond and relate directly to the Wisconsin and Kansan drift areas. The topography of the first province is definitely youthful and, in this area, the Des Moines River Valley

FIGURE III-2

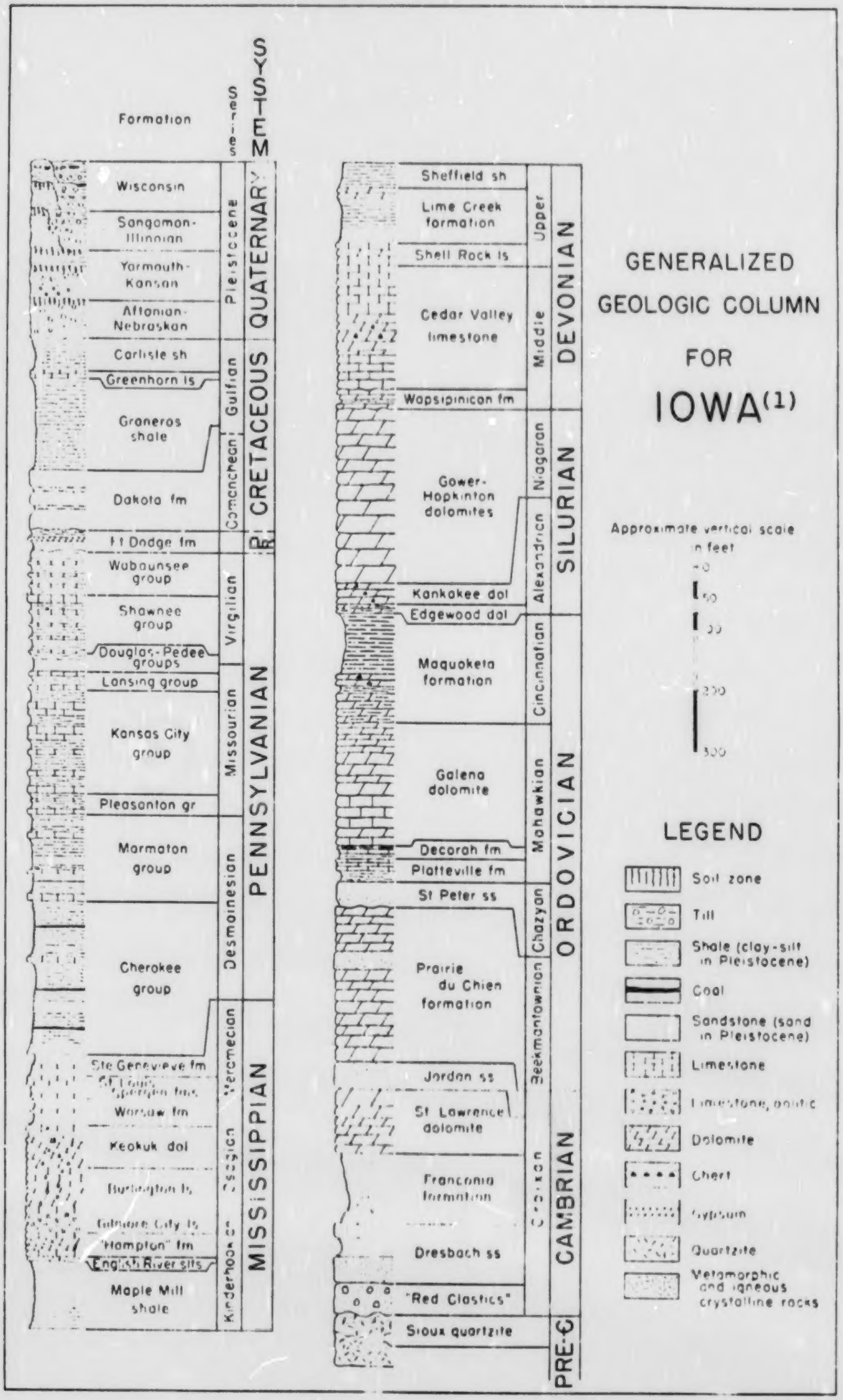
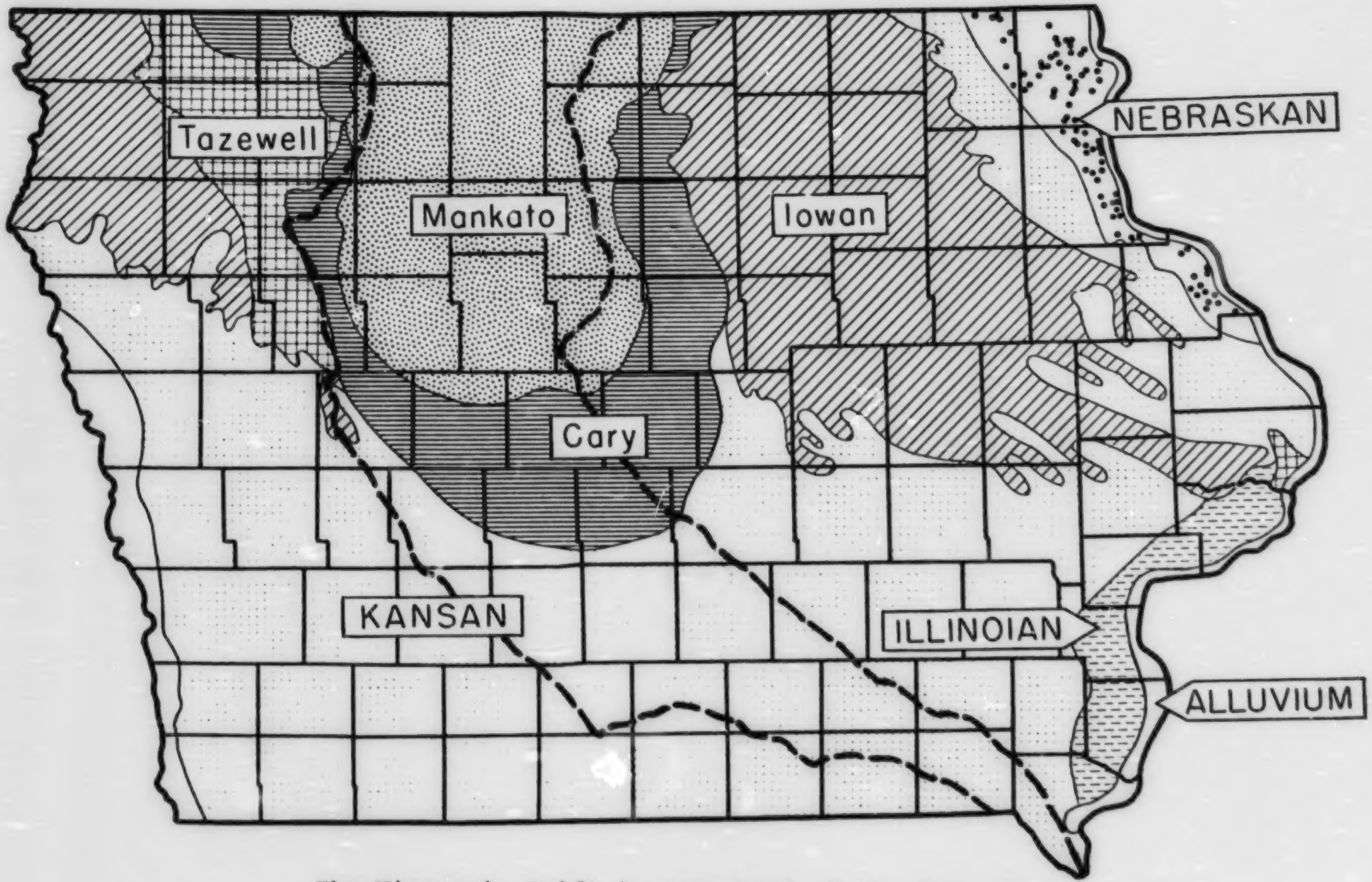

GENERALIZED GEOLOGIC COLUMN FOR IOWA(1)
Formation
Series
SYSTEM
Wisconsin
Sangamon-Illinoian
Yarmouth-Kansan
Aftonian-Nebraskan
Pleistocene
QUATERNARY
Carlisle sh
Greenhorn ls
Graneros shale
Dakota fm
Gulfian
Comanchean
CRETACEOUS
Ft Dodge fm
P-R
Wabaunsee group
Shawnee group
Douglas-Pedee groups
Virgilian
Lansing group
Kansas City group
Pleasanton gr
Missourian
Marmaton group
Cherokee group
Desmoinesian
PENNSYLVANIAN
Ste Genevieve fm
St Louis, Spergen fms
Warsaw fm
Meramecian
Keokuk dol
Burlington ls
Osagian
Gilmore City ls
"Hampton" fm
English River slts
Maple Mill shale
Kinderhookian
MISSISSIPPIAN
Sheffield sh
Lime Creek formation
Upper
Shell Rock ls
Cedar Valley limestone
Middle
Wapsipinicon fm
DEVONIAN
Gower-Hopkinton dolomites
Niagaran
Kankakee dol
Alexandrian
Edgewood dol
SILURIAN
Maquoketa formation
Cincinnatian
Galena dolomite
Decorah fm
Platteville fm
Mohawkian
St Peter ss
Chazyan
Prairie du Chien formation
Jordan ss
Beekmantownian
ORDOVICIAN
St Lawrence dolomite
Franconia formation
Dresbach ss
"Red Clastics"
Croixan
CAMBRIAN
Sioux quartzite
PRE-Є
Approximate vertical scale in feet
0
50
100
200
300
LEGEND
Soil zone
Till
Shale (clay-silt in Pleistocene)
Coal
Sandstone (sand in Pleistocene)
Limestone
Limestone, oolitic
Dolomite
Chert
Gypsum
Quartzite
Metamorphic and igneous crystalline rocks

FIGURE III-3
GLACIAL GEOLOGY OF IOWA (1)


Tazewell
Mankato
Iowan
NEBRASKAN
Cary
KANSAN
ILLINOIAN
ALLUVIUM

The Wisconsin Drift is comprised of the four areas designated as Tazewell, Mankato, Cary, and Iowan displays all the characteristics of youth. In the second province, the topography is mature as is the development of the Des Moines River Valley. The transition between these provinces is abrupt.

The first topographic province is characterized by a wide and uniformly flat plain underlain by Wisconsin glacial drift where the time since glaciation is too brief for much erosion. Except for small areas adjacent to the major streams, the natural drainage consists of shallow trenches at the bottoms of wide sags. As the confluence of the east and west forks of the Des Moines River is approached, the sags grade into definite valleys and in Webster and Boone Counties the river flows in a deep and narrow gorge. Apparently the river flowed here prior to the advance of the Wisconsin ice, and the present gorge is re-excavated in part of the former valley.

The Des Moines River from the Wisconsin drift border near Des Moines to the end of its valley has been long at work and has produced the second topographic province--a vastly more mature landscape on the older Kansan drift surface. Below Des Moines, the river and its tributaries have not only widened their valleys but also by slope wash have rounded the valley slopes. The upland areas, therefore, are well dissected by these numerous tributary valleys so that flat land is almost completely restricted to the flood plains of the streams.

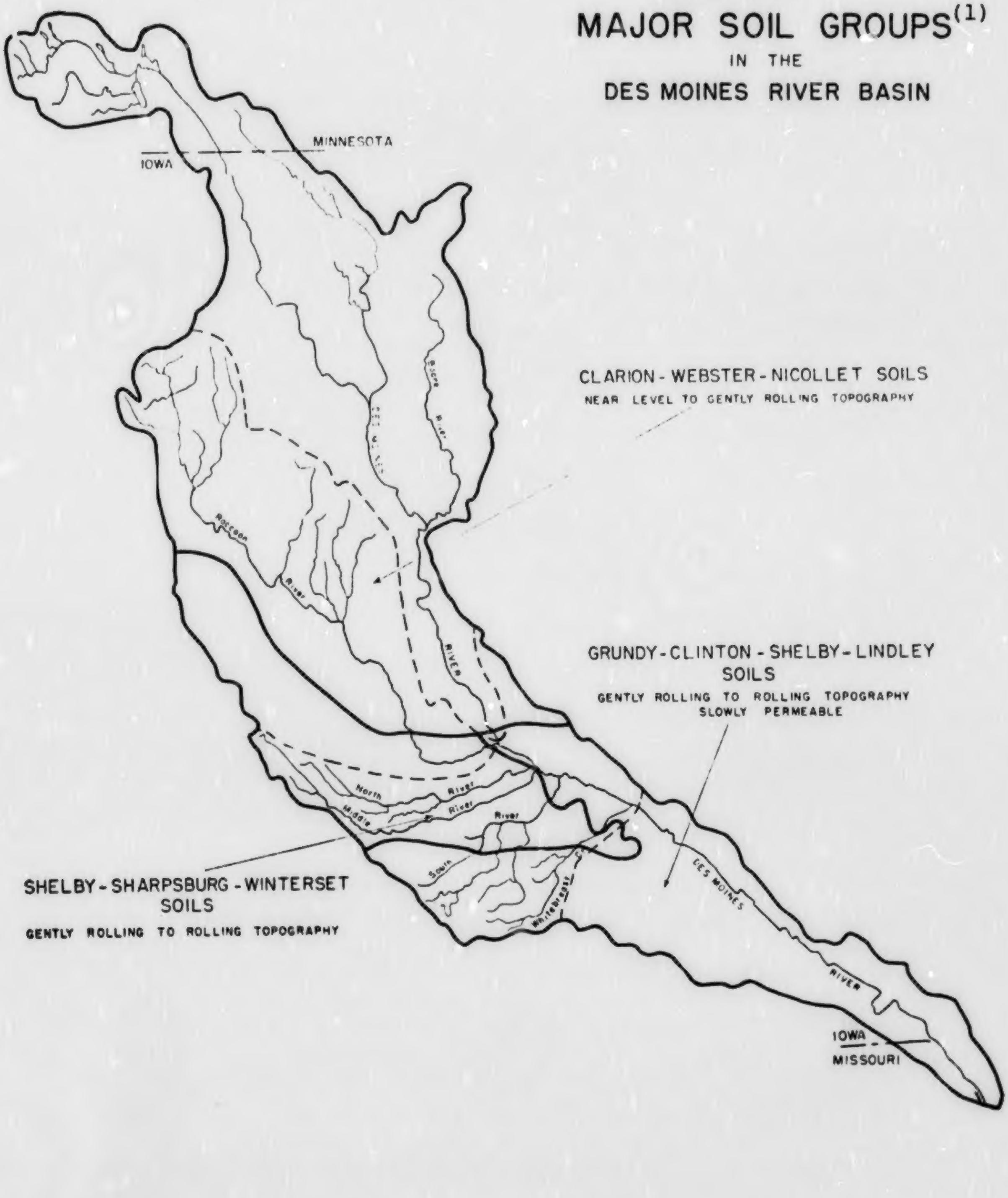
The soil types of the Des Moines River Basin are related to the glacial and associated deposits. The nature of the rock material at the surface determines in large measure the type and fertility of the soil because soils develop by mechanical and chemical weathering of this rock mantle. Throughout the area underlain by Wisconsin tills, an excellent youthful soil has developed. The area covered by the Wisconsin drift, however, is relatively flat, contains numerous shallow lakes and marshes, and is in places underlain by relatively impermeable materials which inhibit downward movement of water and necessitate extensive drainage measures. Here, the water should not be allowed to remain on the land because it prevents aeration of the soil, inhibits the growth of beneficial soil bacteria, keeps the soil cold, and retards the downward extension of plant root systems.

Topsoil in the portion of the basin mantled by Kansan drift varies locally in depth, extent, and fertility. This part of the basin has been subjected to a much longer interval of erosion and the resulting topography is more mature throughout. In this area of rolling hills artificial drainage is seldom needed. Protection of the topsoil and gullies from further erosion is of far greater concern. Figure III-4 shows the major soil groups of the basin.

The surface topography of the basin is being modified continually by erosion. However, changes are relatively slow, for the time schedule is one of geologic era rather than calendar year. It remains to be seen if man's efforts will materially

FIGURE III-4

MAJOR SOIL GROUPS(1) IN THE DES MOINES RIVER BASIN


MINNESOTA
IOWA
Des Moines
Boone River
Raccoon River
RIVER
North River
Middle River
South River
Whitebreast Cr.
DES MOINES RIVER
IOWA
MISSOURI
CLARION - WEBSTER - NICOLLET SOILS
NEAR LEVEL TO GENTLY ROLLING TOPOGRAPHY
GRUNDY - CLINTON - SHELBY - LINDLEY SOILS
GENTLY ROLLING TO ROLLING TOPOGRAPHY
SLOWLY PERMEABLE
SHELBY - SHARPSBURG - WINTERSET SOILS
GENTLY ROLLING TO ROLLING TOPOGRAPHY

affect this geologic time table. Published records (U.S. Geological Survey, 1947) show that during the flood year 1947 the Des Moines River below the Raccoon River transported about six million tons of sediment, 54 percent of which was transported in the month of June alone and 9 percent in a single maximum day. Although this amount of sediment is equivalent to a layer 0.006 inch deep throughout the entire Des Moines Basin above Des Moines, it is believed that a major portion of the sediment came from the lower portion of the Raccoon River. Geologists have estimated that the annual rate of soil production through natural weathering processes is 0.001 inch. Since there is no way of determining what percentage of the measured sediment represented top soil and what percentage represented material scoured from the banks and beds of transporting streams, it is impossible to draw accurate quantitative conclusions regarding the soil loss this sediment load represented.

GENERAL CLIMATOLOGY (1)

Climatological records can be interpreted best by arbitrarily dividing the calendar-year into units corresponding to the growing seasons of the stable crops of the basin. The average winter season around Des Moines, comprising the period when normal daily mean temperatures are less than 40° and plant life is dormant, extends from November 14 to March 23. The spring and fall growing seasons for hardy crops include the periods from March 24 to May 10 and from October 3 to

November 13 when the normal daily mean temperatures are above 40° and less than 59°. The summer season, when mean daily temperatures are 60° or higher and tender crops are grown, is considered to be from May 11 to October 2. The winter dormant season extends 130 days, the spring and fall growing seasons 48 to 42 days, respectively, and the summer growing season 145 days. These periods vary somewhat with location in the basin as the daily mean temperatures decrease generally northward in the basin.

Beginning with the spring growing season, the frequency and intensity of rainfall increase very markedly to a maximum in June. The average total precipitation of the three growing seasons is nearly 27 inches at Des Moines or about 85 percent of the average annual amount. The total for the summer growing season is nearly 19 inches or about 60 percent of the average annual amount. Thus, the major crops of the region nearly always receive the large amounts of moisture they need during their growing season. Annual snowfall averages about 31 inches.

Summer winds are variable, but commonly are from the southern quadrant, bringing moist air from the Gulf of Mexico resulting in precipitation which frequently takes the form of heavy thunderstorms. General droughts have been extremely rare, although summer storms may be so distributed that some areas temporarily receive inadequate moisture.

A more complete discussion of the general climatology of Iowa is given in the Supporting Document (7).

SURFACE WATERS

Stream Flow

That portion of the original precipitation which flows across the land surface and escapes into artificial and natural drainage channels is often referred to as storm runoff. It is the runoff supplemented by discharge from groundwater sources that constitutes the flow observed in streams. Obviously, streamflow is highly correlated to precipitation, which varies from year to year and from area to area. Precipitation and streamflow also vary with time. While some years are in the normal range, others can be either wet or dry.

The average annual runoff in the basin ranges from about three inches in the extreme northwest to more than seven inches in the southeast (4). Runoff follows, in general, the pattern of the mean annual precipitation which ranges from about 28 to about 35 inches from the northwestern to the southeastern parts of the basin (7).

Although no definite cycles are apparent, runoff tends to be above, or below, average for periods longer than one year. The longest periods when runoff was above-average were the two six-year periods 1915-20 and 1942-47. The longest below-average period was the seven years from 1953 to 1959. Statistics on the extremes of annual runoff at selected stations in the basin are listed in Table III-3.

TABLE III-3

ANNUAL RUNOFF AND INDICATORS OF FLOW VARIABILITY FOR SELECTED STATIONS IN THE DES MOINES BASIN (4)

Station Name	Period of Record	Drainage area sq.mi.	Mean flow cfs.	Annual runoff in inches					Q2.33* / Qmean	Q90** / Qmean
				Mean	Max.	Year	Min.	Year		
E.F. Des Moines Riv. nr. Burt	1951-67	462	123	3.53	9.45	1965	.54	1956	16.9	.01
Lizard Cr. nr Clare	1940-67	257	91.5	4.75	12.85	1951	.21	1956	22.5	.02
Boone Riv. nr. Webster City	1940-67	844	352	5.70	14.00	1951	.57	1956	10.7	.04
N. Raccoon Riv. nr. Sac City	1958-67	713	238	4.48	10.41	1962	.62	1968	16.1	.05
E.F. Hardin Cr. nr. Churdan	1952-67	24.0	7.9	4.48	9.81	1962	.32	1956	75.3	.01
Middle Riv. nr. Indianola	1940-67	503	242	6.52	18.31	1947	.48	1968	32.0	.03
South Riv. nr. Ackworth	1940-67	460	229	6.79	17.16	1947	.52	1956	34.4	.01
Cedar Cr. nr. Bussey	1947-67	374	191	6.92	14.70	1960	1.08	1954	32.9	.006
Sugar Cr. nr. Keokuk	1922-31, '58-67	105	66.2	8.55	17.61	1929	.88	1923	33.4	.002

NOTE: Minimum annual annual runoff for period through 1968.
* - Q2.33 is mean annual flood; Qmean is mean flow.
** - Q90 is flow equaled or exceeded 90 percent of time; Qmean is mean flow.

The stations included in Table III-3 are predominantly those measuring the flow from drainage areas of moderate size, and those whose records included the drought of the mid-1950's. The smallest drainage areas are too sensitive to indicate hydrologic conditions; whereas large drainage areas, which integrate widespread meteorologic and physical regimes, are too insensitive to be truly representative of areal conditions.

Streamflow is characteristically variable. Knowledge of average flow alone, is insufficient for careful planning and management. In Iowa, it is common for peak flows to be 10,000 or more times the minimum flows. As an indicator of the variability of high flows, the ratio of the mean annual flood to the mean discharge for selected stations in the basin is listed in Table III-3. The mean annual flood is a fairly stable statistic which is unaffected, for the most part, by the chance occurrence of a very large flood. It is the peak flow that is equaled or exceeded once on an average of about every other year (recurrence interval, 2.33 years). The values for the ratio of the mean annual flood to the mean flow, for stations listed in Table III-3, varied from 10.7 to 75.3.

As an index of the variability of low flows, the ratio of the flow at the 90 percent duration level (Q90) to the mean flow is also listed in Table III-3. The variation of this ratio, from near zero to 0.05, is much less than that for the ratio defining high flows.

From this brief analysis, it is obvious that streamflow is highly variable. On the average, every other year a peak flow is reached that is about 30 or more times the mean flow. During 10 percent of the time, low flows are at or lower than about 3 percent of the mean flow.

Low Flow Characteristics

Water quality criteria of the State of Iowa must be met at all times when the flow of the stream equals or exceeds the statistical 7-day, 1-in-10 year low flow. Information on this flow and the physical characteristics of the stream are needed if the assimilative capacity is to be analyzed and allowable discharges determined.

The United States Geological Survey (USGS) maintains an extensive nationwide network of stream gaging stations. Stream flow is monitored continuously at some stations and periodically at others. By extrapolation of data from this established gage network and review of partial-record stations, additional flow information may be determined for streams where continuously recording gaging stations are not provided. Not all gages in a river basin are of the same period of record; therefore, published values of statistical flows such as Q90 (the flow equalled or exceeded 90% of the time) or the 7-day, 1-in-10 year low flow cannot be expected to correlate exactly at different gages.

Specific USGS gaging station locations are shown on Figures III-5, III-6, and III-7. Both partial-record and continuous recording gaging stations are identified. Tables III-4, III-5, and III-6 list the specific station number, tributary drainage area above the station, and the 7-day, 1-in-10 year low flow, where available, for each station.

As indicated in the tables, insufficient data are available for identification of low flow at each gaging station. In order to conduct waste load allocation analysis, determination of 7-day, 1-in-10 year low flows was conducted for specific gaging stations. These values were obtained using the same procedure conducted by the USGS, but based upon less than 10 years of recorded data. For these reasons, verification of these values, as additional flow information is collected, is required.

The frequency of these extreme low flows is seasonal within the basin, i.e., due to the climatological and geological characteristics of the basin, low flows tend to occur either during August and September or during January and February of any given year. For this reason, analyses of critical conditions for defining waste load allocations must be conducted for both warm and cold water temperatures.

In general, low flows in the Des Moines River Basin are significantly less than the state average when results are reduced to the common basis of discharge per square mile. The low flows per square mile in the Middle Raccoon River and South Raccoon River are considerably higher than the state average as can be seen in Table III-7.

TABLE III-4

U.S.G.S. GAGING STATION INFORMATION (5)
(UPPER DES MOINES SUBBASIN)

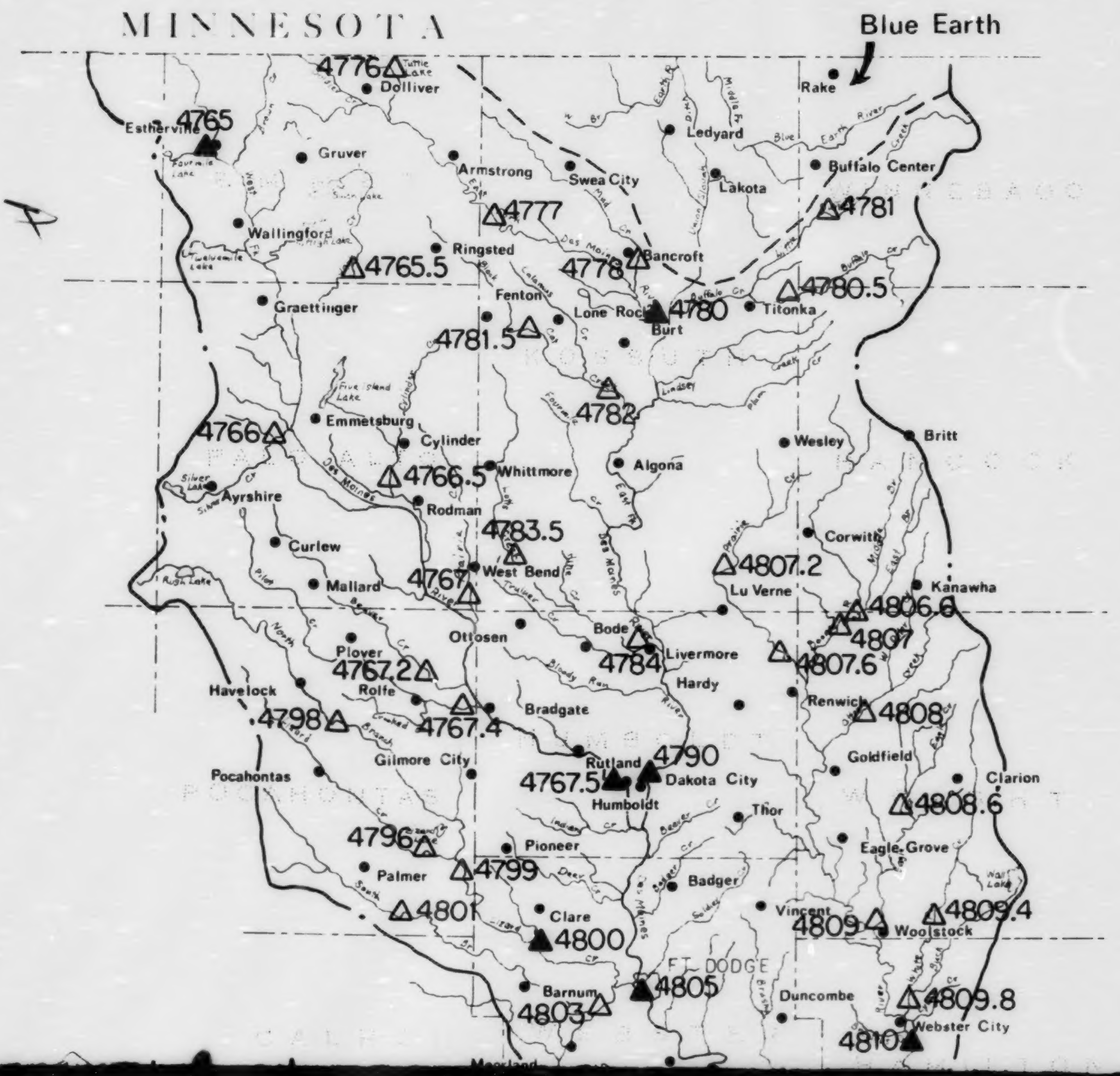
Station No.	Stream	Location	Drainage Area(Mi^2)	7Q10 (cfs)	7Q10 (cfs/mi^2)
4765	W. Fk. Des Moines R.	Estherville	1,372.0	<0.1	---
4765.5	Jack Cr.	Near Emmet Co. Line	74.8	---	---
4766	Silver Cr.	Near Emmetsburg	61.8	0.3	0.0049
4766.5	Cylinder Cr.	Near Rodman	88.6	0.6	0.0068
4767	Prairie Cr.	Near West Bend	61.1	---	---
4767.2	Beaver Cr.	Near Rolfe	62.2	---	---
4767.4	Pilot Cr.	Near Rolfe	97.0	---	---
4767.5[1]	W. Fk. Des Moines R.	Near Humboldt	2,256.0	---	---
4776	E. Fk. Des Moines R.	Near Dolliver	196.0	---	---
4777	E. Fk. Des Moines R.	Near Swea City	314.0	---	---
4778	Mud Cr.	Bancroft	68.1	<0.1	---
4780	E. Fk. Des Moines R.	Near Burt	462.0	---	---
4780.5	Buffalo Cr.	Near Titonka	47.9	0.0	0.0000
4781	North Buffalo Cr.	Near Buffalo Center	62.5	<0.1	---
4781.5	Black Cat Cr.	Near Lone Rock	58.2	---	---
4782	Black Cat Cr.	Near Algona	112.0	---	---
4783.5	Lotts Cr.	Near West Bend	66.2	0.4	0.0060
4784	Lotts Cr.	Livermore	165.0	---	---
4790	E. Fk. Des Moines R.	Dakota City	1,308.0	9.2	0.0070
4796	Lizard Cr.	Near Palmer	66.4	<0.1	---
4798	N. Br. Lizard Cr.	Near Havelock	79.4	<0.1	---
4799	Lizard Cr.	Near Gilmore City	219.0	---	---
4800	Lizard Cr.	Near Clare	257.0	---	---
4801	S. Br. Lizard Cr.	Near Palmer	66.4	---	---

TABLE III-4 (continued)

U.S.G.S. GAGING STATION INFORMATION (5)
(UPPER DES MOINES SUBBASIN)

Station No.	Stream	Location	Drainage Area (Mi^2)	7Q10 (cfs)	7Q10 (cfs/mi^2)
4803	S. Br. Lizard Cr.	Near Fort Dodge	154.0	<0.1	---
4805	Des Moines R.	Fort Dodge	4,190.0	27.0	0.0064
4806.2	Brushy Cr.	Near Homer	88.5	---	---
4806.6	Boone R.	Near Kanawha	71.4	---	---
4807	Boone R.	Near Renwick	134.0	<0.1	---
4807.2	Prairie Cr.	Near Lu Verne	68.6	<0.1	---
4807.6	Prairie Cr.	Near Renwick	118.0	---	---
4808	Otter Cr.	Near Goldfield	75.5	<0.1	---
4808.2	Boone R.	Near Goldfield	419.0	---	---
4808.6	Eagle Cr.	Near Eagle Grove	62.8	---	---
4809	Eagle Cr.	Near Woolstock	105.0	---	---
4809.4	White Fox Cr.	Near Woolstock	62.0	---	---
4809.8	White Fox Cr.	Webster City	111.0	---	---
4810	Boone R.	Near Webster City	844.0	3.6	0.0043
4813[1]	Des Moines R.	Near Stratford (previously near Boone)	5,452.0	41.0	0.0075
4816	Big Cr.	Polk City	91.4	---	---
4816.5[1]	Des Moines R.	Near Saylorville	5,841.0	---	---
4817	Beaver Cr.	Near Beaver	84.5	<0.1	---
4818	Beaver Cr.	Near Berkley	175.0	<0.1	---
4819	Beaver Cr.	Granger	314.0	<0.1	---
4819.5[1]	Beaver Cr.	Near Grimes	358.0	---	---
4820	Des Moines R.	Des Moines	6,245.0	47.0	0.0075

[1] Water Resources Data for Iowa, USGS, 1971


MINNESOTA
Blue Earth
Rake
Ledyard
Buffalo Center
Lakota
Dolliver
Estherville
Gruver
Armstrong
Swea City
Wallingford
Ringsted
Bancroft
Graettinger
Fenton
Lone Rock
Burt
Titonka
Emmetsburg
Cylinder
Whittmore
Algona
Wesley
Britt
Ayrshire
Rodman
Curlew
Mallard
West Bend
Corwith
Kanawha
Lu Verne
Ottosen
Bode
Livermore
Hardy
Renwick
Plover
Havelock
Rolfe
Bradgate
Goldfield
Clarion
Gilmore City
Rutland
Dakota City
Humboldt
Pocahontas
Thor
Pioneer
Eagle Grove
Palmer
Badger
Vincent
Woolstock
Clare
FT. DODGE
Barnum
Duncombe
Webster City
Moorland
KOSSUTH
HANCOCK
WINNEBAGO
PALO ALTO
HUMBOLDT
POCAHONTAS
WRIGHT
CALHOUN
Des Moines
Blue Earth River
Buffalo Cr
Lindsey
Plum Creek
Fourmile Cr
East Fk
Bloody Run
Prairie Cr
Boone River
Lizard Cr
Beaver Cr
Deer Cr
Soldier Cr
Brush Cr
Five Island Lake
Silver Lake
Tuttle Lake
Fourmile Lake
Twelvemile Lake
High Lake
Rush Lake
Nail Lake
4776
4765
4777
4781
4778
4765.5
4780
4780.5
4781.5
4782
4766
4766.5
4783.5
4767
4807.2
4806.6
4807
4784
4807.6
4767.2
4798
4767.4
4808
4790
4767.5
4808.6
4796
4799
4801
4800
4809
4809.4
4805
4803
4809.8
4810

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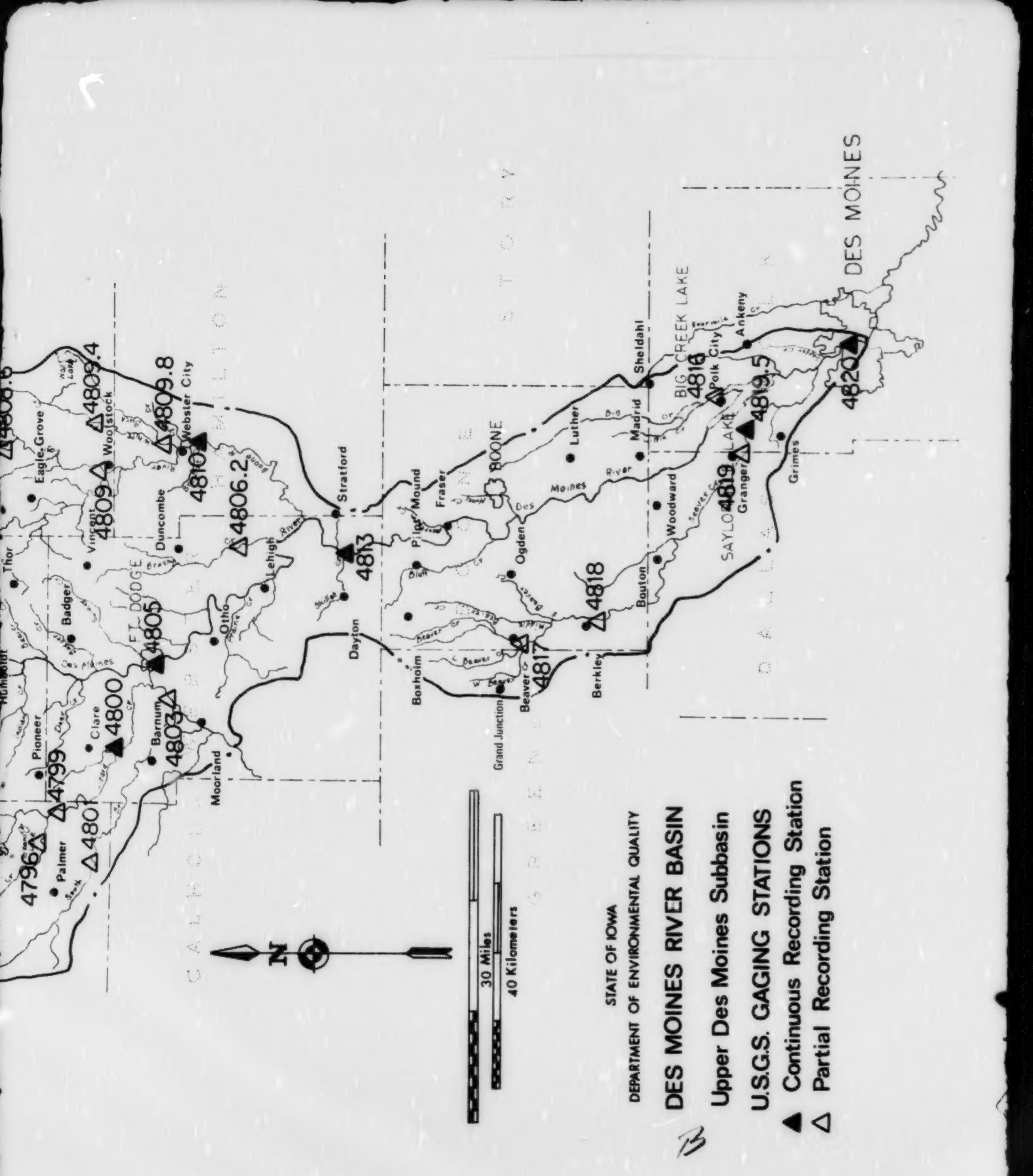
STATE OF IOWA
DEPARTMENT OF ENVIRONMENTAL QUALITY
DES MOINES RIVER BASIN
Upper Des Moines Subbasin
U.S.G.S. GAGING STATIONS
▲ Continuous Recording Station
△ Partial Recording Station
30 Miles
40 Kilometers
N
4796
4799
4800
4801
4803
4805
4806.2
4809
4809.4
4809.8
4810
4813
4816
4817
4818
4819
4819.5
4820
Palmer
Pioneer
Clare
Barnum
Moorland
Badger
Thor
Vincent
Eagle Grove
Woolstock
Webster City
Duncombe
Lehigh
Otho
FT. DODGE
Dayton
Stratford
Boxholm
Pilot Mound
Fraser
BOONE
Ogden
Luther
Madrid
Sheldahl
Woodward
Bouton
Berkley
Beaver
Grand Junction
Polk City
Granger
Ankeny
Grimes
DES MOINES
BIG CREEK LAKE
SAYLORVILLE LAKE
CALHOUN
WEBSTER
HAMILTON
STORY
GREENE
BOONE
DALLAS
POLK
Des Moines River
Boone River
Beaver Cr
Brushy Cr
Lizard Cr
Big Cr
Fourmile Cr

FIGURE III-5

TABLE III-5

U.S.G.S. GAGING STATION INFORMATION (5)
(RACCOON SUBBASIN)

Station No.	Stream	Location	Drainage Area(Mi^2)	7Q10 (cfs)	7Q10 (cfs/mi^2)
4821	N. Raccoon R.	Near Rembrandt	77.4	---	---
4821.2	N. Raccoon R.	Near Truesdale	164.0	---	---
4821.7	Big Cedar Cr.	Near Varina	80.0	---	---
4821.8	Little Cedar Cr.	Near Fonda	83.5	<0.1	---
4822	Big Cedar Cr.	Fonda	196.0	<0.1	---
4822.2	Big Cedar Cr.	Sac City	342.0	---	---
4823	N. Raccoon R.	Near Sac City	713.0	---	---
4823.2	Indian Cr.	Near Lake View	90.2	---	---
4823.6	Camp Cr.	Near Lytton	62.0	<0.1	---
4823.8	Camp Cr.	Near Lake City	147.0	---	---
4824	N. Raccoon R.	Near Lake City	1,003.0	---	---
4824.1	Lake Cr.	Near Rockwell City	71.5	---	---
4824.2	Lake Cr.	Near Lake City	128.0	---	---
4824.4	Purgatory Cr.	Near Lanesboro	65.0	---	---
4824.6	E. Cedar Cr.	Near Somers	62.4	---	---
4824.8	Cedar Cr.	Near Churdan	151.0	---	---
4825	N. Raccoon R.	Near Jefferson	1,619.0	12.0	0.0074
4827	Hardin Cr.	Near Churdan	74.0	---	---
4830	E. Fk. Hardin Cr.	Near Churdan	24.0	0.0	0.0000
4830.5	Hardin Cr.	Near Jefferson	161.0	<0.1	---
4831	W. Buttrick Cr.	Near Farnhamville	80.1	---	---
4831.5	E. Buttrick Cr.	Near Grand Junction	79.6	<0.1	---
4832	Buttrick Cr.	Near Grand Junction	202.0	<0.1	---

TABLE III-5 (continued)

U.S.G.S. GAGING STATION INFORMATION (5)
(RACCOON SUBBASIN)

Station No.	Stream	Location	Drainage Area(Mi^2)	7Q10 (cfs)	7Q10 (cfs/mi^2)
4832.5	Greenrier Cr.	Near Jamaica	65.8	---	---
4833	N. Raccoon R.	Near Perry	2,169.0	16.0	0.0074
4833.1	S. Raccoon R.	Near Guthrie Center	77.2	---	---
4833.2	Brushy Ford Cr.	Near Dedham	68.1	---	---
4833.3	Brushy Ford Cr.	Near Guthrie Center	142.0	---	---
4833.4	S. Raccoon R.	Near Monteith	267.0	---	---
4833.5	Middle Raccoon R.	Near Carroll	74.3	---	---
4833.6	Middle Raccoon R.	Near Glidden	138.0	---	---
4833.8	Willow Cr.	Near Scranton	51.8	<0.1	---
4834	Willow Cr.	Near Bayard	112.0	---	---
4834.5	Middle Raccoon R.	Near Bayard	375.0	---	---
4836	Middle Raccoon R.	Panora	440.0	---	---
4836.2	Mosquito Cr.	Near Linden	67.4	---	---
4836.4	Mosquito Cr.	Near Redfield	110.0	---	---
4836.6	Middle Raccoon R.	Redfield	609.0	---	---
4840	S. Raccoon R.	Redfield	988.0	25.0	0.0253
4842	Panther Cr.	Near Adel	56.0	---	---
4845	Raccoon	Van Beter	3,441.0	31.0	0.0090
4847	Walnut Cr.	West Des Moines	64.0	---	---
4848[1]	Walnut Cr.	Des Moines	80.9	---	---

[1] Water Resources Data for Iowa, USGS, 1972

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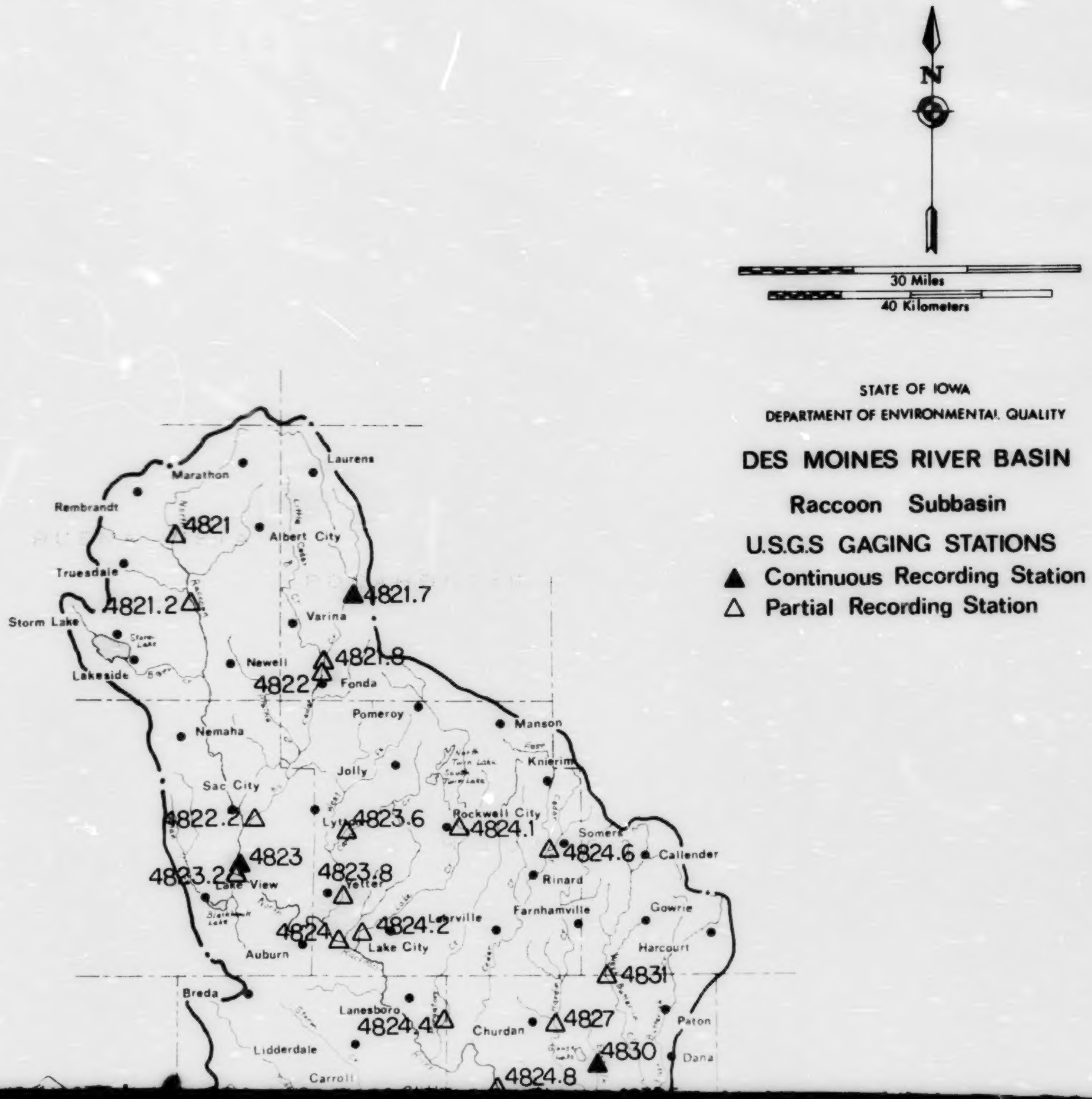


STATE OF IOWA
DEPARTMENT OF ENVIRONMENTAL QUALITY

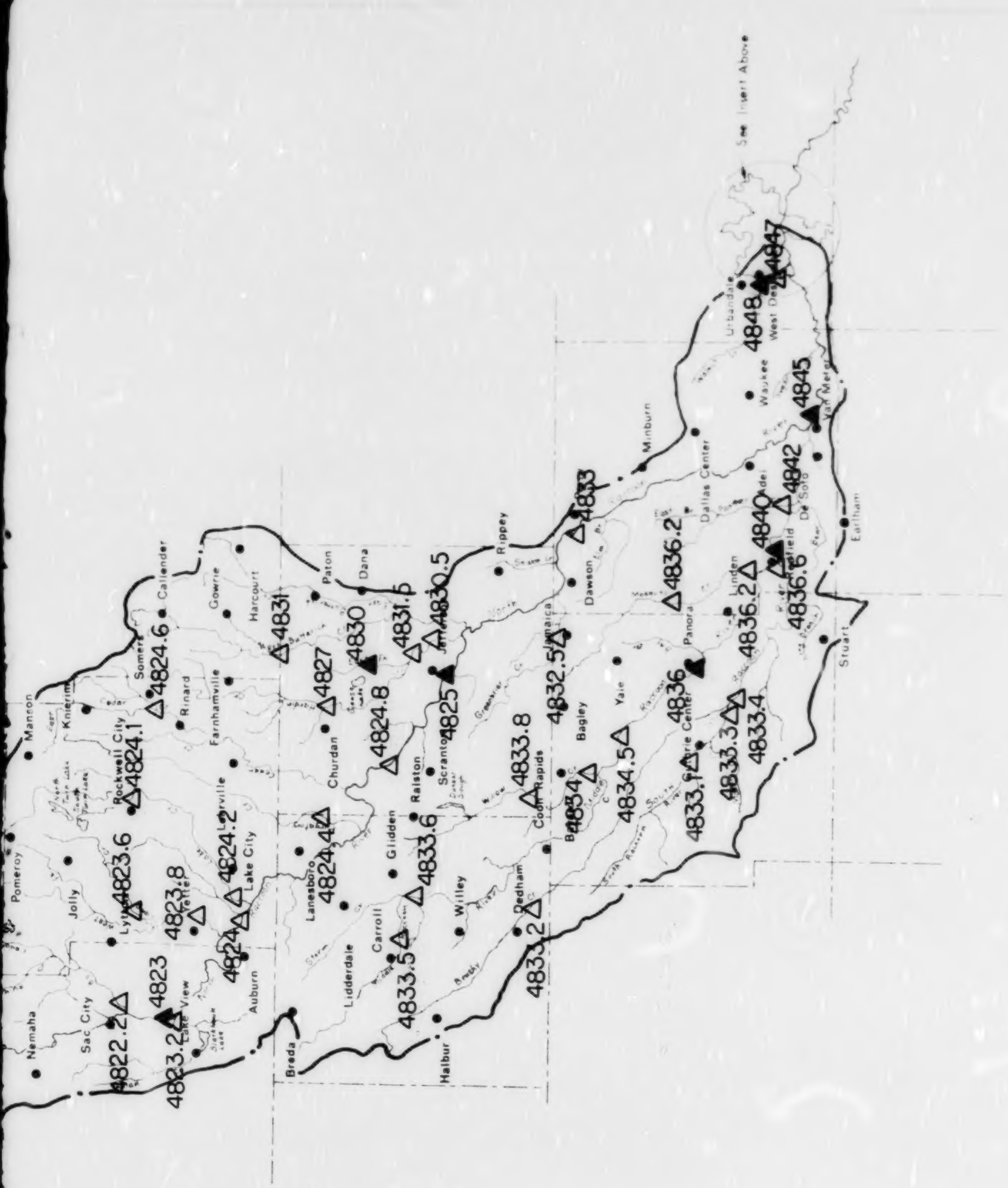
DES MOINES RIVER BASIN

Raccoon Subbasin

U.S.G.S GAGING STATIONS

▲ Continuous Recording Station
△ Partial Recording Station

N
30 Miles
40 Kilometers
Marathon
Laurens
Rembrandt
4821
Albert City
Little Cedar
Truesdale
4821.7
4821.2
Storm Lake
Varina
Storm Lake
Newell
4821.8
Lakeside
4822
Fonda
Pomeroy
Nemaha
Manson
Knierim
North Twin Lake
South Twin Lake
Jolly
Sac City
Rockwell City
4822.2
4823.6
4824.1
Somers
4824.6
Callender
4823
4823.2
4823.8
Rinard
Lake View
Yetter
Farnhamville
Gowrie
Black Hawk Lake
4824
4824.2
Lohrville
Lake City
Auburn
Harcourt
4831
Breda
Lanesboro
4824.4
Churdan
4827
Paton
Lidderdale
4830
Dana
Carroll
4824.8


See Insert Above
Urbandale
West Des Moines
4848
4847
Waukee
4845
Van Meter
Minburn
Dallas Center
Adel
De Soto
4842
4840
Earlham
Redfield
4836.6
4836.2
Linden
Stuart
Rippey
4833
Dawson
Paton
Dana
Callender
Gowrie
Harcourt
4831
4830.5
4831.5
4830
4827
4825
Jefferson
Jamaica
4832.5
Panora
4836
Yale
Bagley
4833.8
4833.3
4833.4
4834.5
Guthrie Center
4833.1
Coon Rapids
Bayard
4834
Scranton
Ralston
Churdan
4824.8
Farnhamville
Rinard
Somers
4824.6
Knierim
Rockwell City
4824.1
Manson
Pomeroy
Jolly
Lytton
4823.6
Lohrville
4824.2
Lanesboro
4824.4
Glidden
4833.6
Willey
Dedham
4833.2
Carroll
4833.5
Lidderdale
Auburn
Lake City
4824
4823.8
Yetter
4823
Lake View
4823.2
Sac City
4822.2
Nemaha
Breda
Halbur
Raccoon River
South Raccoon
Middle

13

FIGURE III-

TABLE III-6

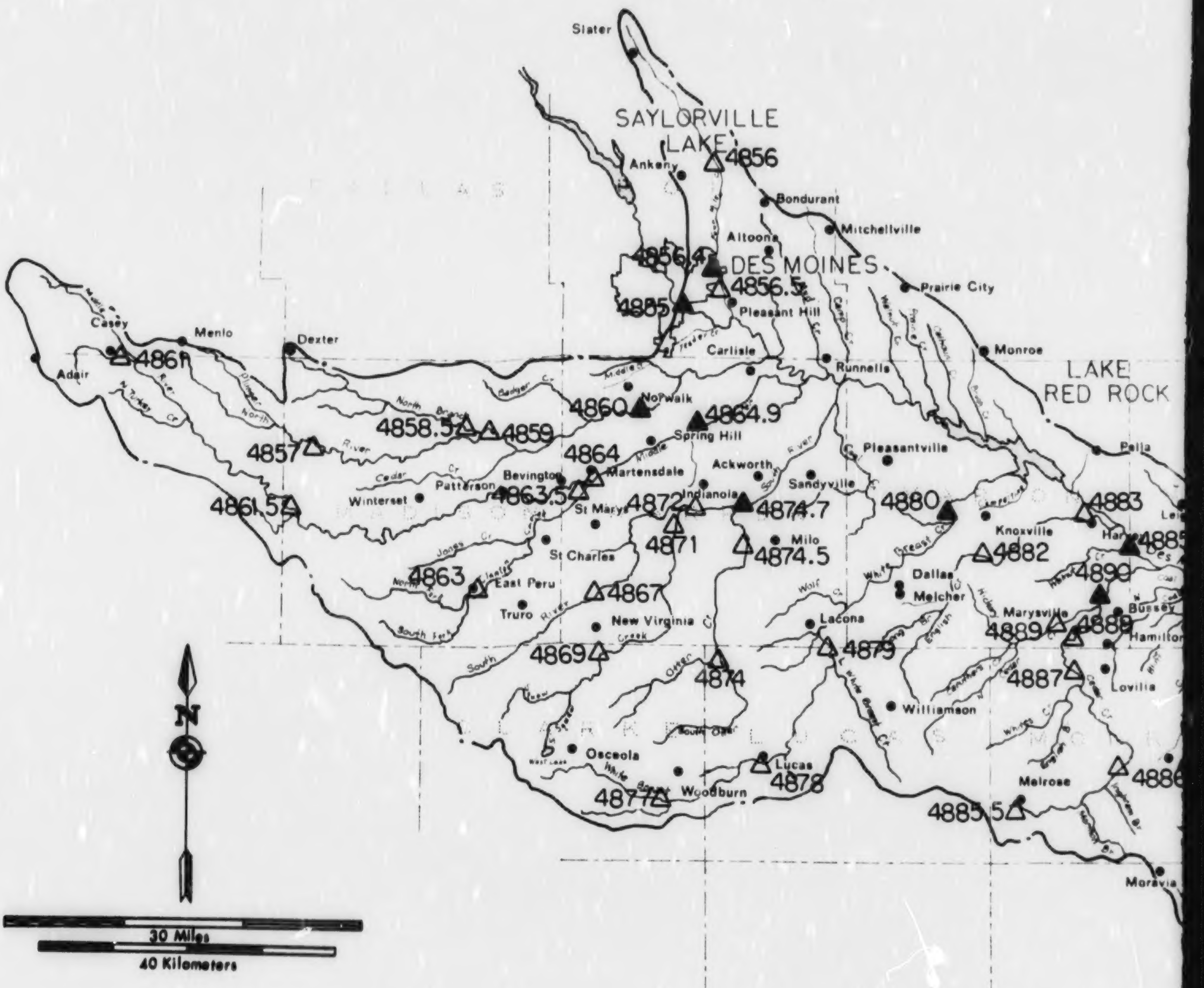
U.S.G.S. GAGING STATION INFORMATION (5)
(LOWER DES MOINES SUBBASIN)

Station No.	Stream	Location	Drainage Area(Mi^2)	7Q10	
				(cfs)	(cfs/mi^2)
4855	Des Moines R.	Below Raccoon R. at Des Moines	9,879.0	82.00	0.0083
4856	Fourmile Cr.	Near Ankeny	59.3	0.00	0.0000
4856.4	Fourmile Cr.	Des Moines	92.7	---	---
4856.5	Fourmile Cr.	Des Moines	95.9	---	---
4857	North R.	Near Earlham	68.9	---	---
4858.5	N. Br. North R.	Near Winterset	74.7	---	---
4859	North R.	Near Winterset	203.0	---	---
4860	North R.	Near Norwalk	349.0	---	---
4861	Middle R.	Near Casey	72.8	---	---
4861.5	Middle R.	Middle River	164.0	---	---
4863	Clanton Cr.	East Peru	84.5	---	---
4863.5	Clanton Cr.	Near Martensdale	159.0	<0.10	---
4864	Middle R.	Martensdale	451.0	---	---
4864.9	Middle R.	Near Indianola	503.0	1.40	0.0028
4867	South R.	Near New Virginia	65.4	---	---
4869	Squaw Cr.	Near Jamison	60.8	0.00	0.0000
4871	Squaw Cr.	Near Indianola	134.0	---	---
4872	South R.	Near Indianola	278.0	---	---
4874	Otter Cr.	Near Norwood	102.0	0.00	0.0000
4874.5	Otter Cr.	Near Milo	155.0	<0.10	---
4874.7	South R.	Near Ackworth	460.0	0.64	0.0014
4877	White Breast Cr.	Near Woodburn	82.9	0.00	0.0000
4878	White Breast Cr.	Lucas	128.0	0.00	0.0000

TABLE III-6 (continued)

U.S.G.S. GAGING STATION INFORMATION (5)
(LOWER DES MOINES SUBBASIN)

Station No.	Stream	Location	Drainage Area(Mi^2)	7Q10	
				(cfs)	(cfs/mi^2)
4879	White Breast Cr.	Near Newbern	243.0	<0.10	---
4879.8	White Breast Cr.	Near Dallas	342.0	---	---
4880	White Breast Cr.	Near Knoxville	380.0	0.53	0.0014
4882	English Cr.	Near Knoxville	73.0	0.00	0.0000
4883	English Cr.	Near Harvey	108.0	0.00	0.0000
4885	Des Moines R.	Near Tracy	12,479.0	112.00	0.0090
4885.5	Cedar Cr.	Melrose	23.9	0.00	0.0000
4886	Cedar Cr.	Near Albia	102.0	---	---
4887	Cedar Cr.	Near Lovilia	211.0	<0.10	---
4888	N. Cedar Cr.	Near Lovilia	61.3	---	---
4889	N. Cedar Cr.	Near Marysville	111.0	<0.10	---
4890	Cedar Cr.	Near Bussey	374.0	---	---
4893	N. Avery Cr.	Near Chillicothe	60.1	0.00	0.0000
4894	S. Avery Cr.	Near Chillicothe	51.6	0.00	0.0000
4895	Des Moines R.	Ottumwa	13,374.0	100.00	0.0075
4899	Soap Cr.	Near Ash Grove	97.3	0.00	0.0000
4901	Soap Cr.	Near Floris	243.0	---	---
4902	Lick Cr.	Kilbourn	82.7	0.00	0.0000
4903	Chequest Cr.	Near Troy	85.0	0.00	0.0000
4904	Chequest Cr.	Near Pittsburg	123.0	<0.10	---
4905	Des Moines R.	Keosauqua	14,038.0	126.00	0.0090
4907	Sugar Cr.	Near Charleston	62.3	0.00	0.0000
4910	Sugar Cr.	Near Keokuk	105.0	0.00	0.0000


Slater
SAYLORVILLE LAKE
4856
Ankeny
Bondurant
Mitchellville
Altoona
4856.4
DES MOINES
4856.5
Prairie City
4885
Pleasant Hill
Casey
Menlo
Dexter
4861
Adair
Carlisle
Runnells
Monroe
LAKE RED ROCK
4860
Norwalk
4864.9
4858.5
4859
4857
Spring Hill
Pleasantville
Pella
4864
Martensdale
Ackworth
Sandyville
Bevington
Patterson
Winterset
4863.5
4861.5
St Marys
4872
Indianola
4874.7
4880
4883
4871
Milo
4874.5
Knoxville
4882
St Charles
4863
East Peru
4867
Dallas
Melcher
4890
Truro
New Virginia
Lacona
Marysville
4889
4888
Bussey
Hamilton
4869
4879
4874
4887
Lovilia
Williamson
Osceola
Lucas
4878
4886
Woodburn
4877
Melrose
4885.5
Moravia
N
30 Miles
40 Kilometers

STATE OF IOWA

DEPARTMENT OF ENVIRONMENTAL QUALITY

DES MOINES RIVER BASIN

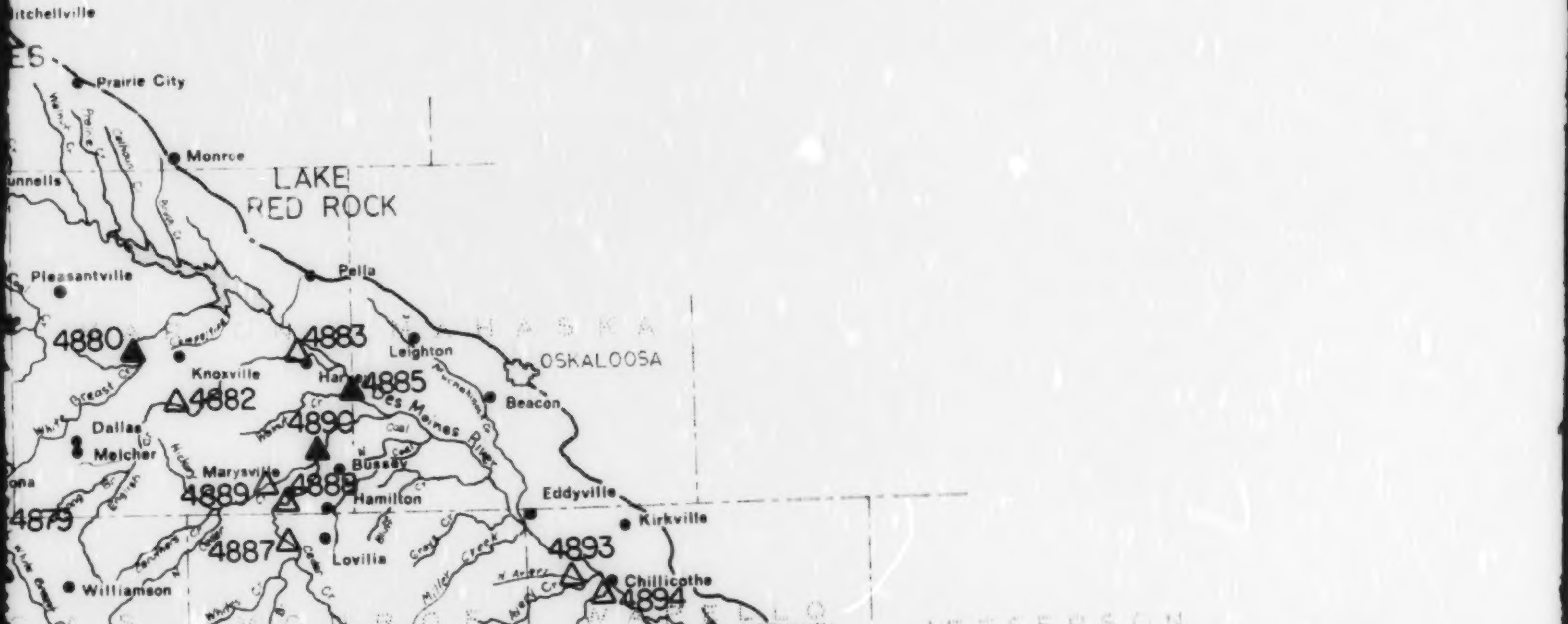
Lower Des Moines Subbasin

U.S.G.S. GAGING STATIONS

▲ Continuous Recording Station

△ Partial Recording Station

A


Mitchellville
Prairie City
Monroe
LAKE RED ROCK
Pleasantville
Pella
Leighton
OSKALOOSA
Beacon
Knoxville
Dallas
Melcher
Marysville
Bussey
Hamilton
Lovilia
Williamson
Eddyville
Kirkville
Chillicothe
OTTUMWA
JEFFERSON
Albia
Melrose
Blakesburg
Libertyville
Eldon
Floris
Moravia
Keosauqua
Bonaparte
Farmington
Donnellson
KEOKUK
APPANOOSE
DAVIS
LEE
Des Moines River
4879
4880
4882
4883
4885
4885.5
4886
4887
4888
4889
4890
4893
4894
4895
4899
4901
4902
4903
4904
4905
4907
4910
MISSOURI

B

FIGURE III-7

Low flow in the Des Moines River below Red Rock Dam has been regulated since the reservoir was first filled in April 1969. The Corps of Engineers' operating procedure calls for a minimum low flow of 300 cfs to be maintained at Ottumwa.

Low flows in the Des Moines River will also be influenced by Saylorville Dam in the near future. Data from the Corps of Engineers indicate the minimum discharge will be 200 cfs.

Table III-7 shows a comparison of averages from long-term continuously recording gaging stations within the basin to the average for 84 stations within the State of Iowa.

As with the daily flow data presented, the average 7-day, 1-in-10 year low flow for the basin is considerably lower than that for the entire state. The 7-day, 1-in-10 year low flow for the Upper Des Moines Subbasin averages 0.0054 cfs/sq mi, while the State of Iowa averages 0.020 cfs/sq mi.

HYDROGEOLOGY (1, 4)

Of the principal aquifers, the highly productive ones can be divided into two categories on the basis of their recharge and water-yielding characteristics. In one category are the highly productive alluvial and shallow carbonate-rock aquifers directly underlying and in hydrologic connection with principal streams. In the other category are the deep, highly productive

TABLE III-7

FLOW COMPARISONS(5)

	Flow, in cfs/sq mi, Equaled or Exceeded, for Percentage of Time Indicated in Column Headings				
	50	90	95	98	99
State of Iowa Average	0.150	0.033	0.024	0.018	0.015
Upper Des Moines R. (average all gages)	0.094	0.012	0.008	0.005	0.004
North Raccoon R. nr Sac City (USGS 5-4823)	0.087	0.017	0.010	0.004	0.002
North Raccoon R. nr. Jefferson (USGS 5-4825) 5-4825)	0.130	0.020	0.014	0.009	0.007
Middle Raccoon R. at Panora (USGS 5-4836)	0.180	0.061	0.050	0.043	0.039
South Raccoon R. at Redfield (USGS 5-4840)	0.172	0.053	0.040	0.032	0.028
Raccoon R. at Van Meter (USGS 5-4845)	0.142	0.027	0.018	0.012	0.009
Des Moines R below Raccoon R. at Des Moines (USGS 5-4855)	0.177	0.027	0.016	0.012	0.010

artesian aquifers in Iowa that are a considerable distance from recharge sources. These deeply buried aquifers act as conduits carrying water from outcrop areas miles or hundreds of miles to the areas of natural or artificial discharge.

Surficial Aquifers

Unconsolidated sediments varying in texture from nearly impermeable clay to highly permeable gravel are present throughout the Des Moines River Basin. Some of the unconsolidated sediments are very productive of water, and are major sources of water supply at several localities. Because of their near-surface locations, mostly near rivers, they can be economically developed with relatively shallow wells and low pumping lifts, and are dependable sources of supply. These deposits are used widely for stock and domestic supplies.

Alluvial deposits underlying the flood plains and terraces of the Des Moines River and its major tributaries constitute productive aquifers that are currently and potentially important sources of water. These reservoirs are relatively small, but they have large storage characteristics and are recharged normally at rather frequent intervals. Recharge occurs from local precipitation and seepage from adjacent streams where withdrawals are large. Therefore they are dependent on surface water quality and quantity.

Sand and gravel deposits along the Des Moines River are capable of yielding more than 500 gpm to individual wells, and deposits along the tributaries and in some buried valleys are capable of yielding more than 40 gpm to individual wells. The largest single municipal supply in Iowa, at Des Moines, is obtained from sand and gravel along the Raccoon River.

Boone also develops its supply from deposits along the Des Moines River. Downstream from near Des Moines the sand and gravel are highly productive but are confined mostly to the immediate valley of the Des Moines River. Upstream from Des Moines, in the Western Lake section, the deposits are more widespread but many are only moderately productive of ground water.

Glacial drift consists principally of pebbly and sandy boulder clay containing lenticular or shoestring bodies of sorted sand and some poorly sorted sand and gravel. The drift thickness ranges from zero to 600 feet and averages about 200 feet. The producing zones are the sand bodies within or at the base of the drift. Wells may range from 15 to 20 feet to as deep as 400 feet or more. Generally, these wells yield only a few gallons per minute, but with favorable conditions and proper well design as much as 10 to 20 gpm may be obtained. Generally, the best deposits are found in the northern portion of the basin.

Bedrock Aquifers

Major portions of the Des Moines River are underlain by bedrock formations that can be depended on to yield moderate to large amounts of water to wells. Much of the area is underlain by more than one of these aquifers, separated by the relatively impermeable aquicludes. In such area the developer of groundwater may choose between the aquifers on the basis of depth, yield, pumping lift, water quality, or other considerations. In most of the basin these aquifers are not heavily stressed; however, in a few small areas of concentrated pumping the water levels have declined noticeably but not alarmingly.

Although very small supplies may be obtained locally from most of the permeable beds, the important aquifers are the Dakota sandstone, lower Pennsylvanian sandstone, Mississippian limestone, Cedar Valley limestone, St. Peter sandstone, Jordan sandstone, and Dresbach sandstone (1).

The Dakota sandstone yields moderate to large quantities of water in the upper part of the basin. Pennsylvanian sandstone occurs beneath much of the basin, but commonly yields only small supplies because of the low permeability. Mississippian limestones, which include several distinct water-bearing beds, yield moderate supplies to wells in the northern part of the basin but only a few gallons per minute throughout the cental and southern portions. The Cedar Valley limestone is penetrated by a few wells, and yields small supplies of water. The St. Peter, Jordan, and Dresbach sandstones occur at considerable depth throughout the basin. They constitute large reservoirs that may be drawn upon heavily when the need arises. Throughout much of the basin, however, they occur so deeply buried that the cost of development is now prohibitive for many small towns and rural industry.

For further information a more detailed discussion of hydrogeology for the state is given in the Supporting Document (7).

GROUND WATER QUALITY (1, 4)

The mineral content of the groundwater, described by total dissolved solids and hardness, generally increases with increasing depth. Some alluvial aquifers will yield water with a hardness of from 150 to 200 mg/l, and water from some bedrock aquifers in areas where they yield highly mineralized water often will have a hardness in excess of 1,000 mg/l. These waters usually grade from calcium or calcium magnesium to the sodium type and from bicarbonate to sulfate or chloride type in areas where the dissolved-solids content increases.

Generally, water containing less than 500 mg/l of dissolved solids can be found in the alluvial aquifers of the basin except in the area of the main stem of the Raccoon River where between 500 and 1000 mg/l is expected. Dissolved solids in the Dakota aquifer varies from less than 500 mg/l in the northern portions of the basin to greater than 1000 in the far northwestern corner. In the Mississippian aquifer dissolved solids range from less than 500 mg/l in the north central portion of the basin to greater than 2500 mg/l in the southwestern. In the far northeastern corner, dissolved solids in the Silurian-Devonian aquifer are generally less than 500 mg/l but greater than 2500 mg/l over about the southern one third of the basin. In areas of the northeast and central east dissolved solids of less than 500 mg/l can be obtained from the Jordan aquifer but the concentration increases to greater than 2000 in the southwest corner of the basin.

Iron occurs in amounts (more than 0.3 mg/l) which can cause problems in some places in all aquifers. Iron in troublesome amounts is commonly found in water from the alluvial aquifers, in sand aquifers beneath the glacial drift, and in near-surface bedrock aquifers.

Nitrates in excess of acceptable concentrations have been found in many shallow wells. The occurrence of high nitrate concentrations is related more to improper well construction and location than to a particular region. Instances of properly constructed wells yielding high nitrate concentrations are, however, common in some alluvial aquifers.

Fluoride may be high in water taken from the Mississippian aquifer in central and southern portions of the basin.

For further information on ground water quality, a more detailed discussion is given in the Supporting Document (7).

REFERENCES

1. An Inventory of Water Resources and Water Problems, Des Moines River Basin, Iowa, prepared by the Iowa Natural Resources Council, 1953.
2. R. H. Shaw and P. J. Waite. The Climate of Iowa III Monthly, Crop Season and Animal Temperature and Precipitation Normals for Iowa, Agricultural and Home Economics Experiment Station, Iowa State University of Science and Technology, Ames, Iowa, April 1964.
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4. Water Resources of Iowa, Ed. Paul J. Horick, University Printing Service, Iowa City, Iowa, January 1970.
5. Low Flow Characteristics of Iowa Streams Through 1966, Albert J. Heinitz, prepared by the U.S. Geological Survey, Water Resources Division, in cooperation with the Iowa Natural Resources Council, State of Iowa, 1970.
6. Upper Mississippi River Comprehensive Basin Study, Vol. III, Appendix E: Ground Water and Geology, prepared by the Economic Advisory Committee, Upper Mississippi River Basin Coordinating Committee, 1970.
7. Supporting Document for Iowa Water Quality Management Plans, Iowa Department of Environmental Quality, Water Quality Management Division, Des Moines, Iowa.

CHAPTER IV - WATER QUALITY

The main objective of water quality management is to protect and enhance the water resources to ensure acceptable conditions for designated uses. Sound management first requires knowledge of the existing water quality.

Existing water quality for the Des Moines River Basin has been identified from available data. The data indicate some areas of degraded water quality.

It is the purpose of water quality standards to limit waste inputs to streams so that designated water uses will not be impaired.

The Iowa Water Quality Commission has classified streams into four classifications: A, B, C, and General. Class A Waters are those which are to be preserved for whole body contact. Class B Waters are those which are to be preserved for wildlife, aquatic life, and non-body contact recreation. Class C Waters are those which must be of a quality to meet requirements for use as a potable water supply. The General classification, which applies to all surface waters, provides for generally acceptable physical conditions and elimination of toxic substances. The Supporting Document for Iowa Water Quality Management Plans, lists the standards in detail for each class.

In addition to material contamination, thermal discharges are important to water quality, since many life forms cannot adapt to a wide range of temperature. Temperature variation within a stream can result in different proportions of species and may even result in the disappearance of some forms and the appearance of others. Standards have been set for thermal discharges and streams have been further classified as to being "cold water" or "warm water".

Table IV-1, from the Water Quality Standards, Chapter 16, Iowa Departmental Rules, lists the classification of streams in the Des Moines River Basin, and Figure IV-1, IV-2, and IV-3 shows those streams classified A, B, or C.

The U.S. Environmental Protection Agency (EPA) has prepared a set of proposed criteria for water quality that differs in some instances from Iowa's standards. These are also presented in the Supporting Document. It is likely that Iowa's standards and EPA standards will become very nearly identical. Although the present standards may be different, their purposes are the same -- to manage water quality to meet the best interest of all users.

SAMPLING LOCATIONS

The evaluation of water quality in the Des Moines River Basin is based upon data collected by the DEQ, the State Health Department, the State Hygienic Laboratory, and Iowa State University. Some additional data are available from other State, local, and Federal agencies.

Table IV-1

SURFACE WATER CLASSIFICATION

DES MOINES RIVER BASIN

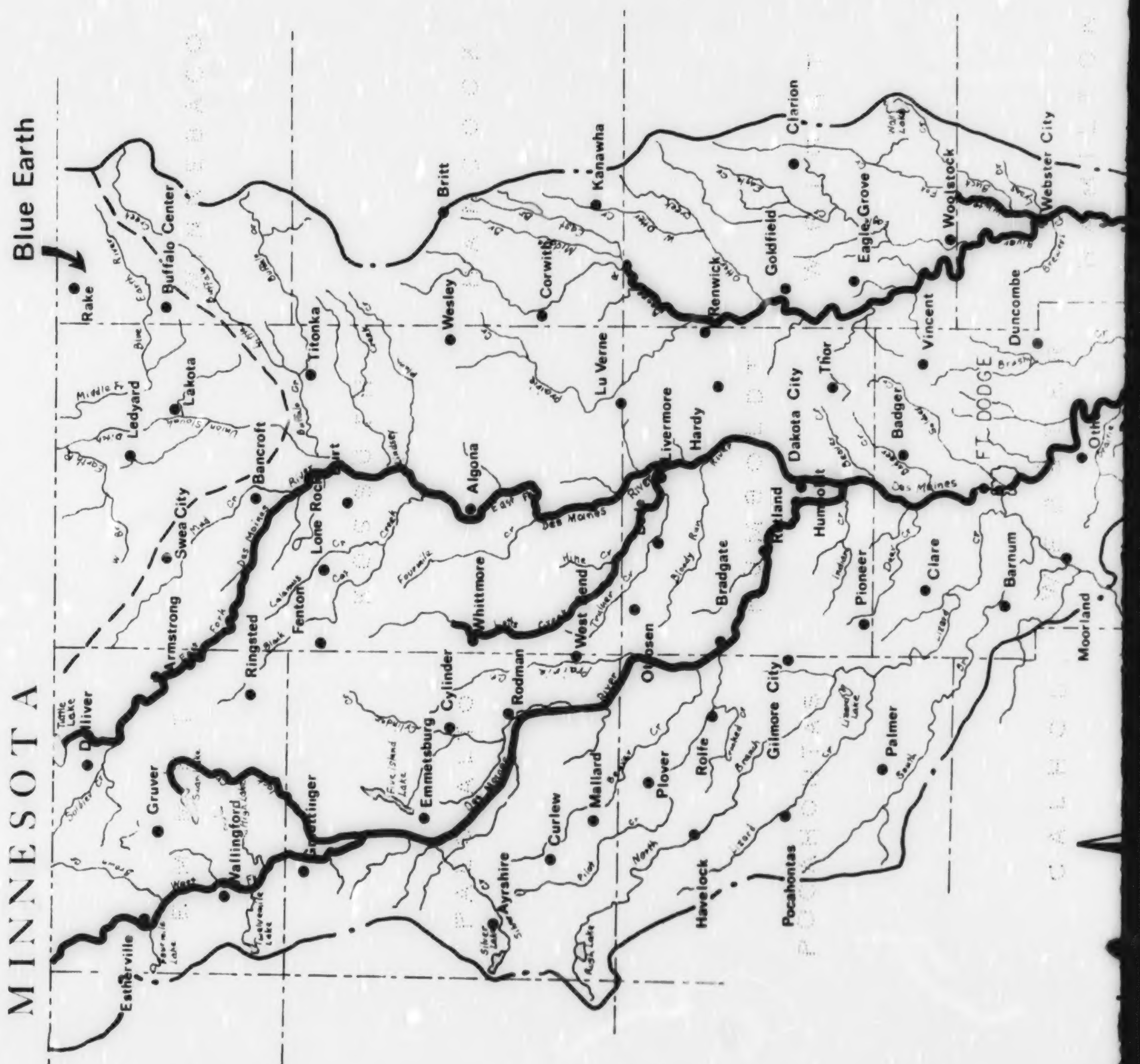
Stream Segment	Classification A	Classification B Warm water	Classification C
A. Mississippi River - Main Stem Mo. State line to Minn. State line	X	X	X (Above) Keokuk Ft. Madison Burlington & Davenport
1. Des Moines River mouth to Bonaparte Dam		X	
Bonaparte Dam impoundment	X	X	
Bonaparte Dam impoundment to Ottumwa power plant dam		X	
Ottumwa power plant dam impoundment	X	X	X (Above) Ottumwa
Ottumwa power plant dam impoundment to Red Rock Dam		X	
Red Rock Reservoir	X	X	
Red Rock Reservoir to Des Moines Center St. Dam		X	
Des Moines Center St. Dam to Interstate 80-35	X	X	
Interstate 80-35 to Saylorville Dam		X	
Saylorville Reservoir	X	X	
Saylorville Reservoir to upper dam at Ft. Dodge		X	
Upper Ft. Dodge Dam Impoundment	X	X	
Upper Ft. Dodge Dam Impoundment to confl. of E & W Forks		X	
a. Sugar Cr. mouth to Lee Co. Road J72		X	
b. Chequest Cr. mouth to Davis Co. line		X	
c. Middle R. mouth to Adair Co. line		X	

Table IV-1 (Cont.)

SURFACE WATER CLASSIFICATION

DES MOINES RIVER BASIN

Stream Segment		Classification	
	A	B Warm Water	C
d. Raccoon R. mouth to confl. of North and South Raccoon Rivers		X	X (Above Des Moines)
(1) North Raccoon R. mouth to Buena Vista Co. line		X	
(2) South Raccoon R. mouth to Highway 44		X	
(a) Middle Raccoon R. mouth to Lake Panorama Dam		X	X (Above Panora)
Lake Panorama	X	X	
Lake Panorama to Carroll Co. Road E 57		X	
e. Beaver Cr. mouth to Dallas Co. line		X	
f. Big Cr. mouth to Big Cr. Dam		X	
Big Cr. impoundment	X	X	
Big Cr. impoundment to Boone Co. line		X	
g. Boone R. mouth to Hancock Co. line		X	
(1) White Fox Cr. mouth to Wright Co. line		X	
h. W. Fork Des Moines R. fork to Minn. State line		X	
(1) Jack Cr. mouth to Swan Lake		X	
i. E. Fork Des Moines R. fork to Tuttle Lake		X	
(1) Lotts Cr. mouth to Highway 18		X	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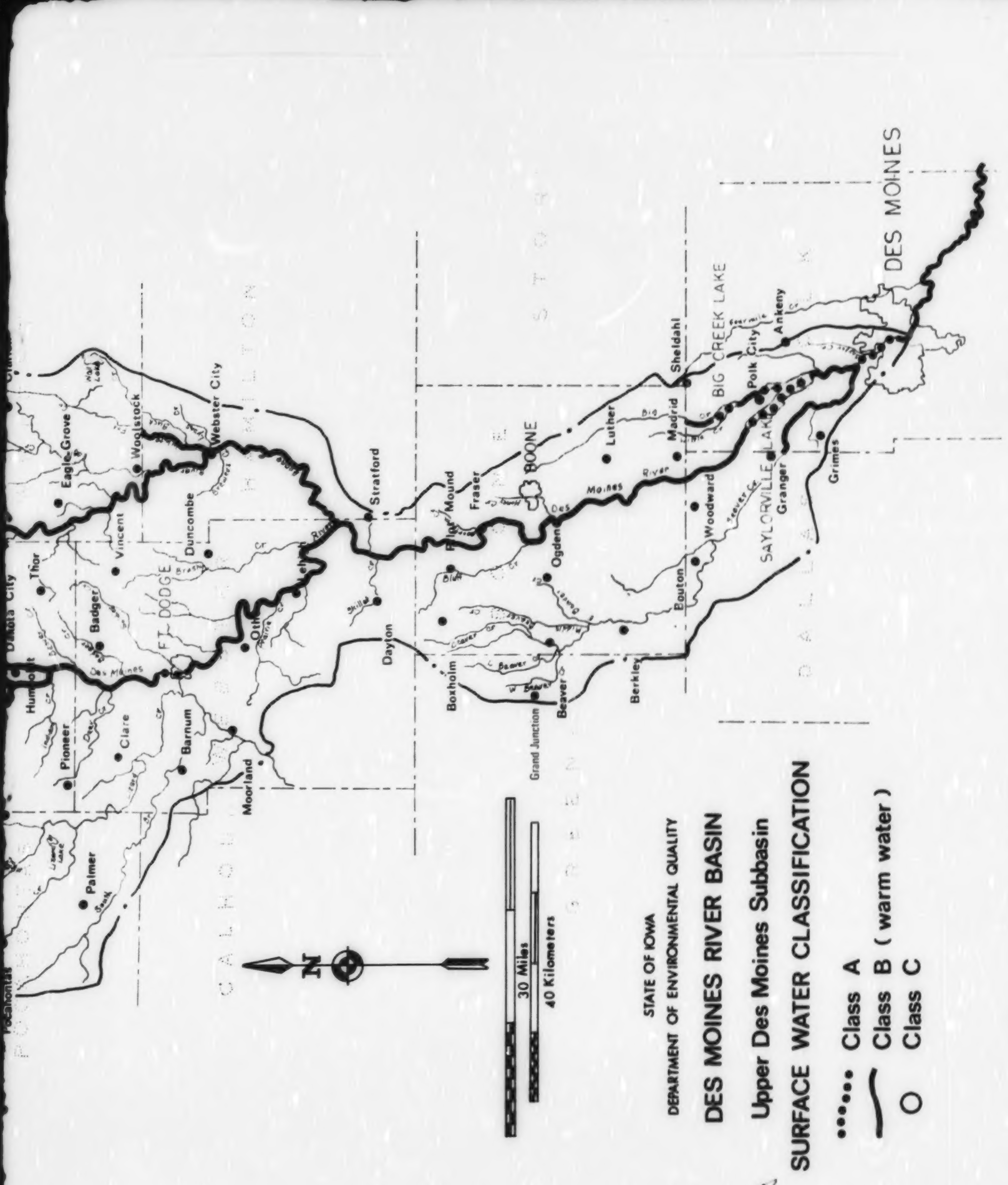
Blue Earth
Rake
Buffalo Center
Britt
Kanawha
Clarion
Ledyard
Lakota
Titonka
Wesley
Corwith
Renwick
Goldfield
Eagle Grove
Woolstock
Webster City
Bancroft
Swea City
Armstrong
Dolliver
Tuttle Lake
Estherville
Gruver
Wallingford
Graettinger
Ringsted
Fenton
Lone Rock
Burt
Algona
Whittemore
West Bend
Rodman
Cylinder
Emmetsburg
Five Island Lake
Ayrshire
Silver Lake
Curlew
Mallard
Plover
Rolfe
Gilmore City
Havelock
Pocahontas
Palmer
Ottosen
Bradgate
Rutland
Humboldt
Livermore
Hardy
Lu Verne
Dakota City
Thor
Vincent
Badger
Duncombe
FT. DODGE
Pioneer
Clare
Barnum
Moorland
Des Moines River
East Fork
West Fork
Black Cr
Fourmile Cr
Bloody Run
Lizard Cr
Boone River
Prairie Cr

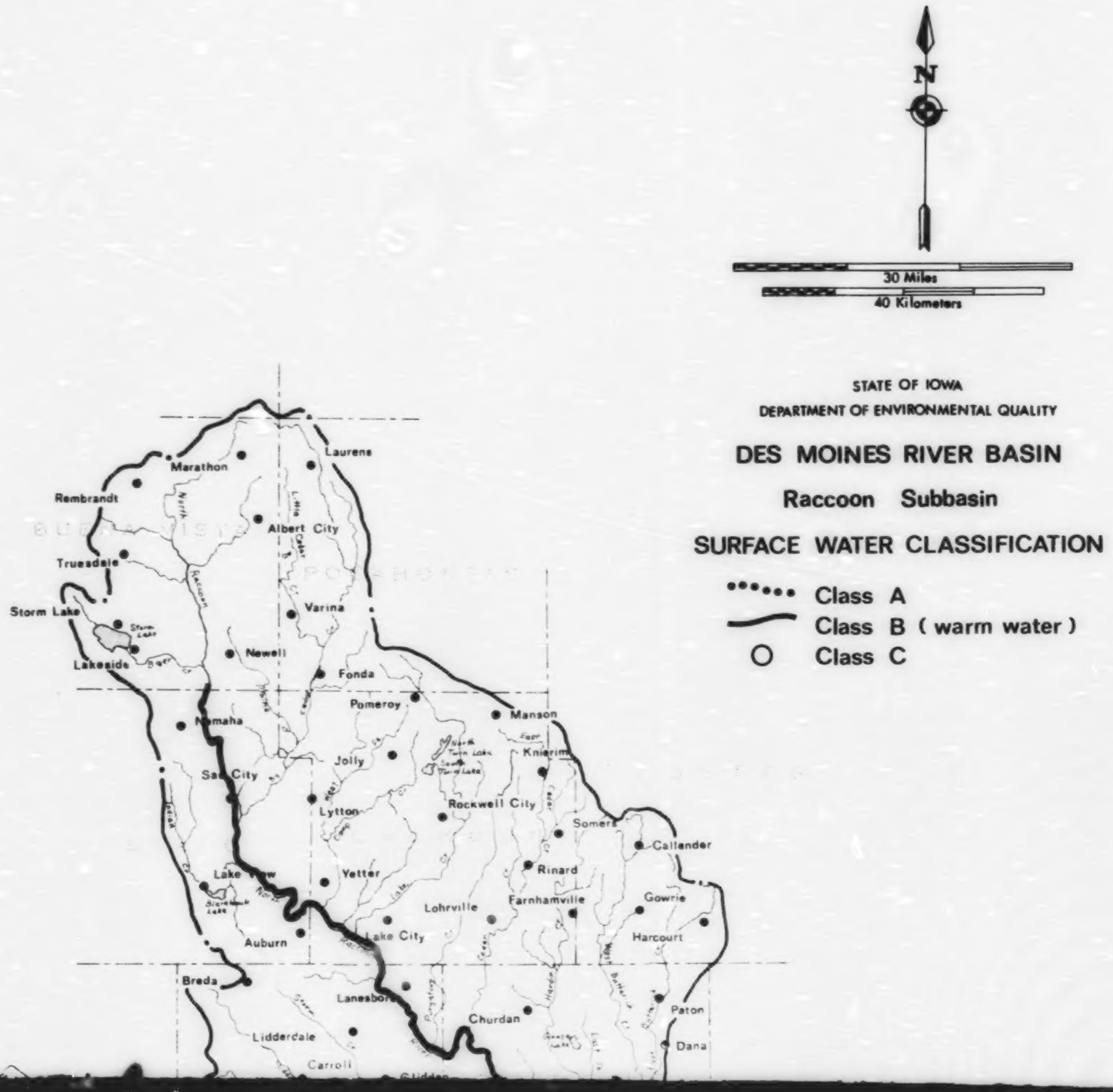
A


STATE OF IOWA
DEPARTMENT OF ENVIRONMENTAL QUALITY
DES MOINES RIVER BASIN
Upper Des Moines Subbasin
SURFACE WATER CLASSIFICATION
Class A
Class B (warm water)
Class C
30 Miles
40 Kilometers
N
POCAHONTAS
CALHOUN
WEBSTER
HAMILTON
GREENE
BOONE
STORY
DALLAS
POLK
FT. DODGE
BOONE
DES MOINES
BIG CREEK LAKE
SAYLORVILLE LAKE
Pocahontas
Palmer
Pioneer
Clare
Barnum
Moorland
Humboldt
Dakota City
Thor
Badger
Vincent
Eagle Grove
Woolstock
Webster City
Duncombe
Lehigh
Otho
Stratford
Dayton
Boxholm
Grand Junction
Beaver
Berkley
Pilot Mound
Fraser
Ogden
Luther
Madrid
Sheldahl
Woodward
Bouton
Granger
Grimes
Polk City
Ankeny
Des Moines
Des Moines River
Boone River
Lizard Cr.
Brushy Cr.
Beaver Cr.
Big Cr.
Fourmile Cr.
Skillet Cr.
Bluff Cr.
Beaver Cr.
W. Beaver
Prairie Cr.
Lotts Cr.
Twin Lakes
Ledges
Lake

B

FIGURE IV-1

A



STATE OF IOWA
DEPARTMENT OF ENVIRONMENTAL QUALITY

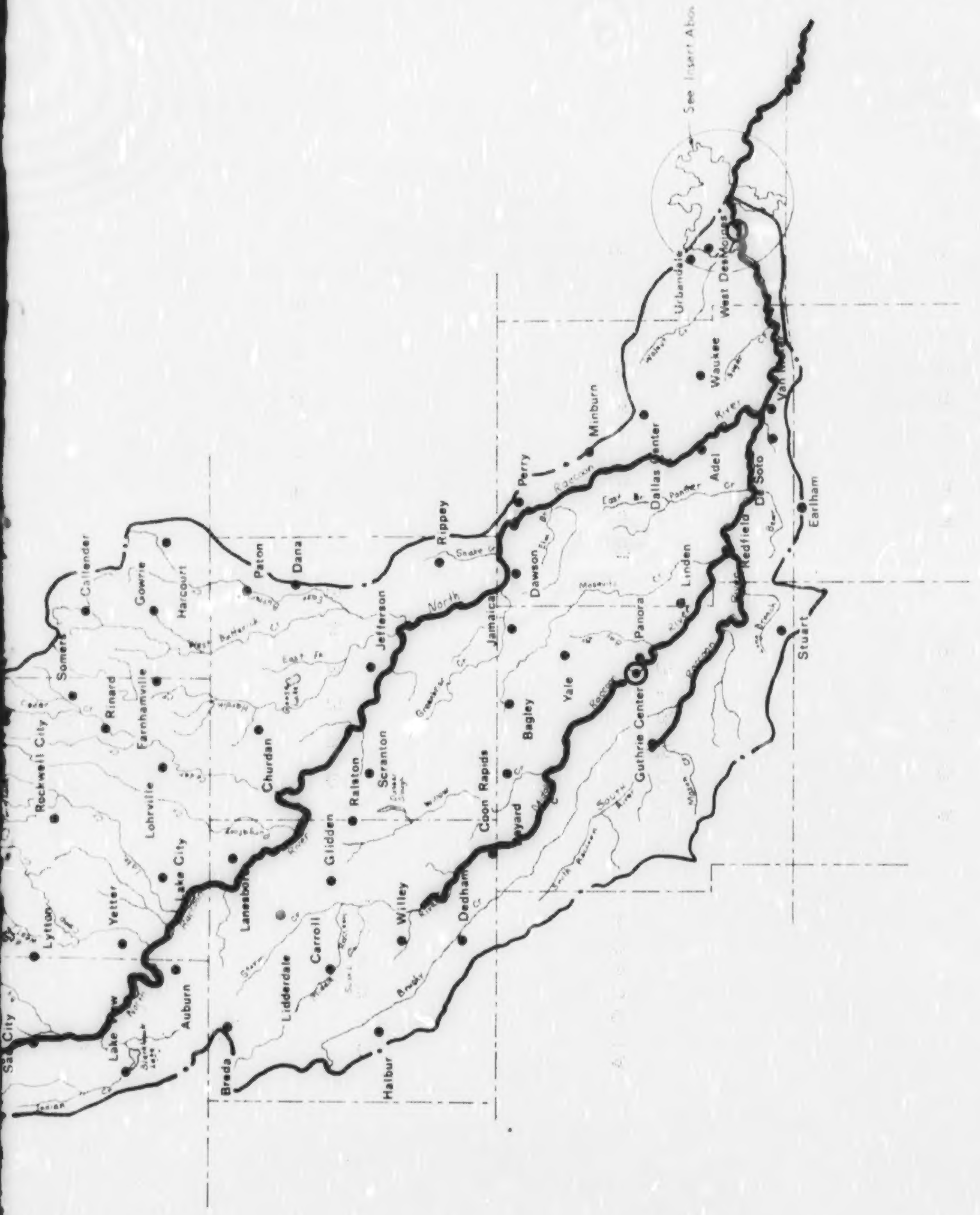
DES MOINES RIVER BASIN

Raccoon Subbasin

SURFACE WATER CLASSIFICATION

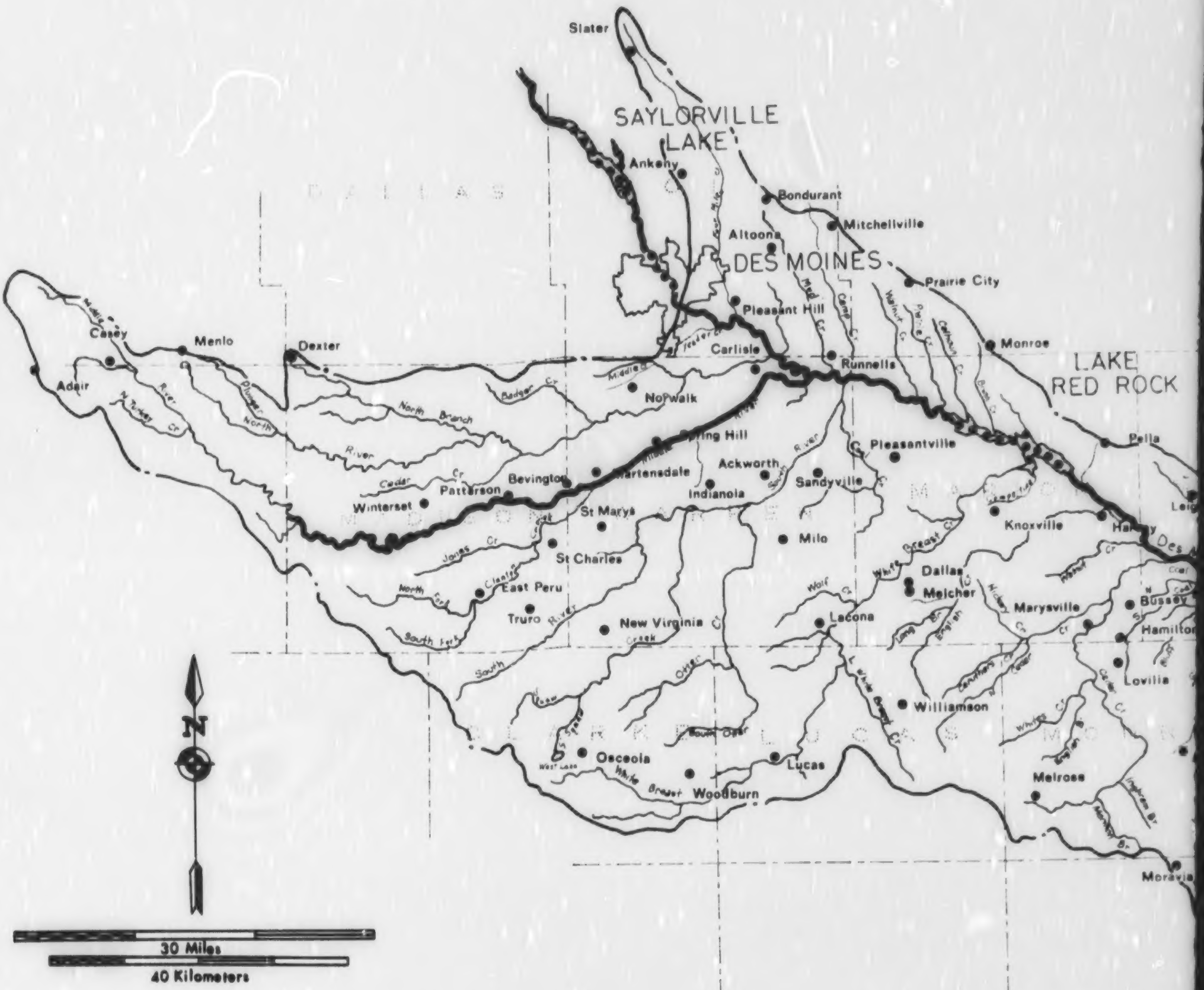
- ••••••• Class A
- ─── Class B (warm water)
- ○ Class C

N
30 Miles
40 Kilometers
Laurens
Marathon
Rembrandt
Albert City
North
Little Cedar Cr.
Truesdale
Raccoon
Storm Lake
Storm Lake
Varina
Lakeside
Newell
Fonda
Pomeroy
Manson
Nemaha
Jolly
North Twin Lake
South Twin Lake
Knierim
Sac City
Lytton
Rockwell City
Cedar
Somers
Callender
Lake View
Blackhawk Lake
Yetter
Rinard
Lohrville
Farnhamville
Gowrie
Auburn
Lake City
Harcourt
Breda
Lanesboro
Churdan
Paton
Lidderdale
Dana
Carroll
Glidden


See Insert Abo
Urbandale
West Des Moines
Waukee
Walnut Cr
Sugar Cr
Minburn
Perry
Dallas Center
Adel
River
Van Meter
De Soto
Earlham
East Br. Panther Cr
Redfield
Linden
Panora
Stuart
Guthrie Center
Yale
Bagley
Jamaica
Dawson
Rippey
Snake Cr
Dana
Paton
Harcourt
Gowrie
Callender
Somers
Rinard
Farnhamville
Rockwell City
Lohrville
Churdan
Jefferson
North
West Buttrick Cr
East Fk
Scranton
Ralston
Glidden
Coon Rapids
Bayard
Middle
South River
Dedham
Willey
Carroll
Lidderdale
Lanesboro
Lake City
Yetter
Lytton
Auburn
Lake
City
Breda
Halbur
Brushy
Indian Cr

B

FIGURE IV-2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SAYLORVILLE LAKE
Ankeny
Bondurant
Mitchellville
Altoona
DES MOINES
Prairie City
Pleasant Hill
Monroe
LAKE RED ROCK
Runnells
Carlisle
Casey
Menlo
Dexter
Adair
Norwalk
Spring Hill
Pleasantville
Pella
Martensdale
Ackworth
Sandyville
Bevington
Patterson
Indianola
Winterset
St Marys
Knoxville
Milo
St Charles
Dallas
Melcher
East Peru
Truro
Lacona
Marysville
Bussey
Hamilton
New Virginia
Lovilia
Williamson
Osceola
Lucas
Melrose
Woodburn
Moravia
DALLAS
MADISON
WARREN
MARION
CLARKE
LUCAS
MONROE
APPANOOSE
North Branch
Middle River
South River
Cedar Cr
Badger Cr
Clanton Cr
North Fork
South Fork
Jones Cr
Otter Creek
White Breast Cr
English Cr
Whitebreast
Wolf Cr
Cedar Cr
Walnut Cr
Camp Cr
Mud Cr
Fourmile Cr
Des Moines
N
30 Miles
40 Kilometers

STATE OF IOWA

DEPARTMENT OF ENVIRONMENTAL QUALITY

DES MOINES RIVER BASIN

Lower Des Moines Subbasin

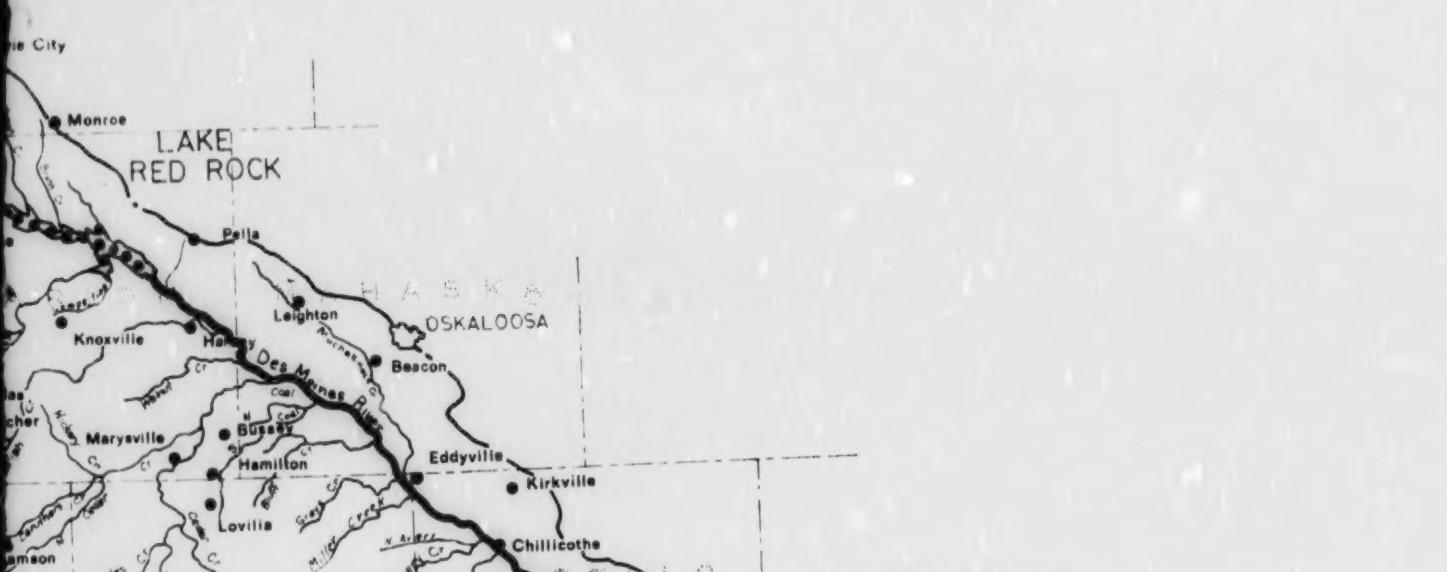
FACE WATER CLASSIFICATION

•••• Class A

— Class B (warm water)

O Class C

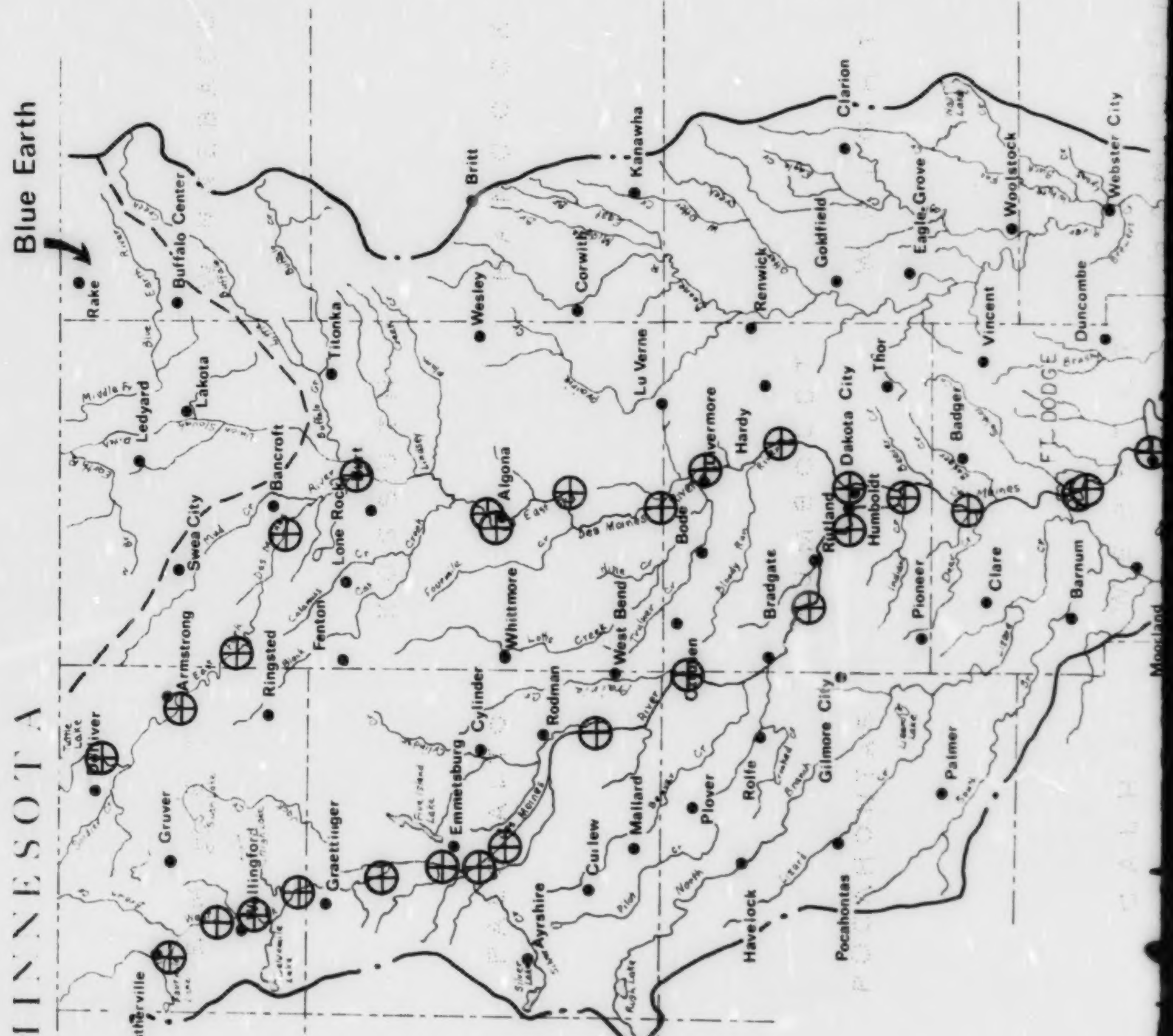
A


Monroe
LAKE RED ROCK
Pella
Leighton
OSKALOOSA
Knoxville
Des Moines River
Beacon
Maryville
Bussey
Hamilton
Eddyville
Kirkville
Lovilia
Chillicothe
OTTUMWA
JEFFERSON
Albia
Melrose
Blakesburg
Libertyville
Eldon
Floris
Moravia
DAVIS
VAN BUREN
Keosauqua
Bonaparte
APPANOOSE
Farmington
Donnellson
LEE
MISSOURI
KEOKUK
Soap Cr
South Soap Cr
Chequest Cr
South Chequest Cr
Fox River
Lick Cr
Sugar Cr
Indian Cr
Cedar Cr
Avery Cr
Village Cr
Mississippi River

B

FIGURE IV-3

All sampling locations in the Upper Des Moines River, Raccoon, and Lower Des Moines Subbasins are shown on Figure IV-4, IV-5, and IV-6, respectively.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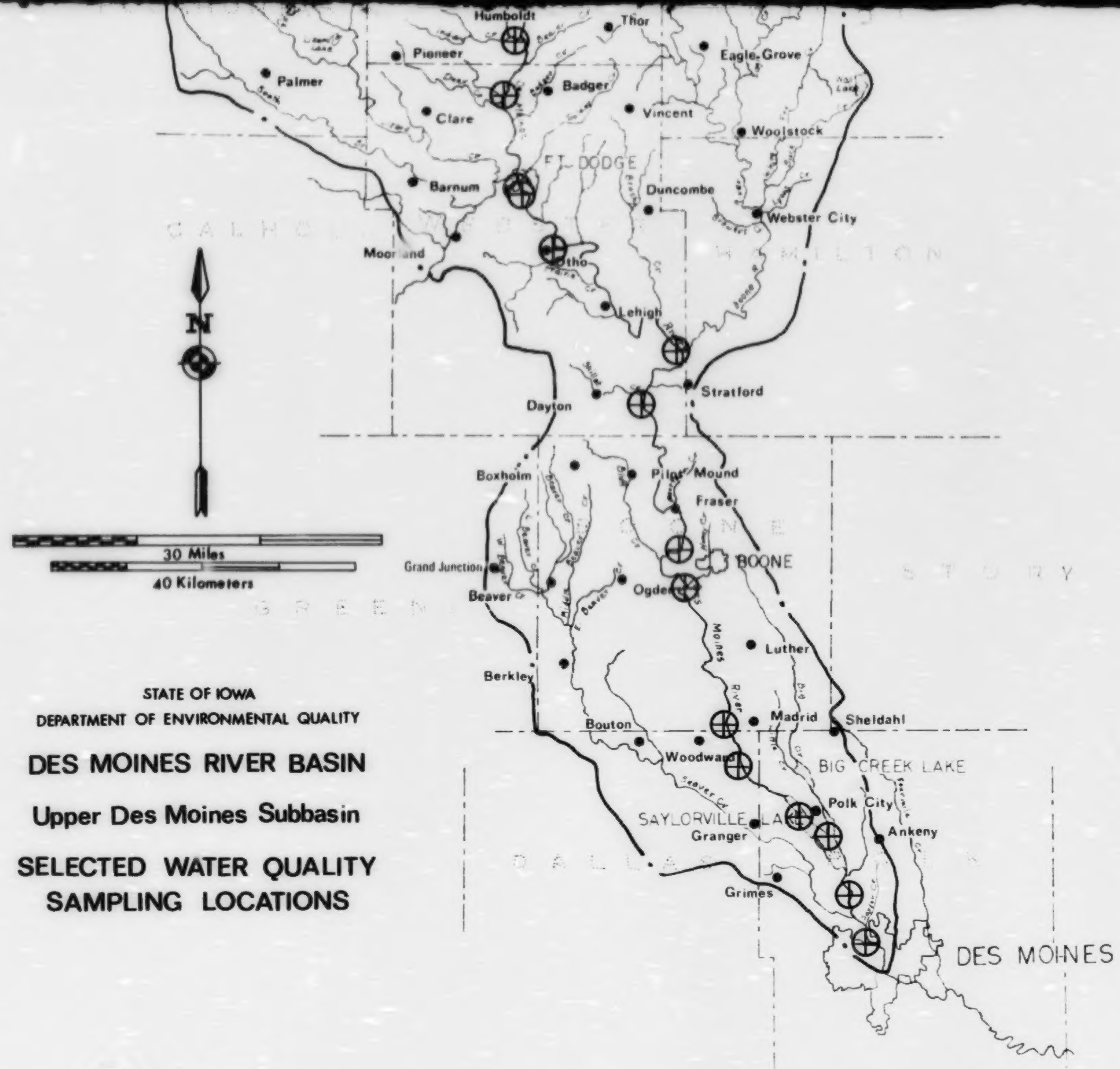
Blue Earth
Rake
Buffalo Center
Lakota
Ledyard
Bancroft
Swea City
Armstrong
Ringsted
Dolliver
Gruver
Wallingford
Estherville
Graettinger
Emmetsburg
Cylinder
Rodman
Ayrshire
Curlew
Mallard
Plover
Rolfe
Havelock
Pocahontas
Gilmore City
Palmer
West Bend
Whittmore
Fenton
Lone Rock
Titonka
Algona
Wesley
Britt
Corwith
Kanawha
Lu Verne
Livermore
Bode
Ottosen
Bradgate
Rutland
Humboldt
Dakota City
Hardy
Renwick
Goldfield
Clarion
Eagle Grove
Thor
Badger
Pioneer
Clare
Barnum
Vincent
Woolstock
Webster City
Duncombe
FT. DODGE
Moorland
Des Moines River
East Fork
Five Island Lake
Silver Lake
Tuttle Lake

A


Humboldt
Thor
Pioneer
Eagle Grove
Palmer
Badger
Clare
Vincent
Woolstock
FT. DODGE
Barnum
Duncombe
Webster City
CALHOUN
WEBSTER
HAMILTON
Moorland
Otho
Lehigh
N
Stratford
Dayton
Boxholm
Pilot Mound
Fraser
BOONE
30 Miles
40 Kilometers
Grand Junction
Beaver
Ogden
STORY
GREENE
Moines
Luther
Berkley
River
Madrid
Sheldahl
Bouton
Woodward
BIG CREEK LAKE
Polk City
SAYLORVILLE LAKE
Granger
Ankeny
DALLAS
Grimes
DES MOINES

STATE OF IOWA
DEPARTMENT OF ENVIRONMENTAL QUALITY

DES MOINES RIVER BASIN

Upper Des Moines Subbasin

SELECTED WATER QUALITY SAMPLING LOCATIONS

B

FIGURE IV-4

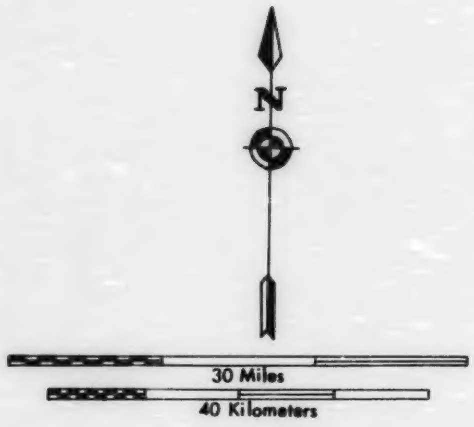
A

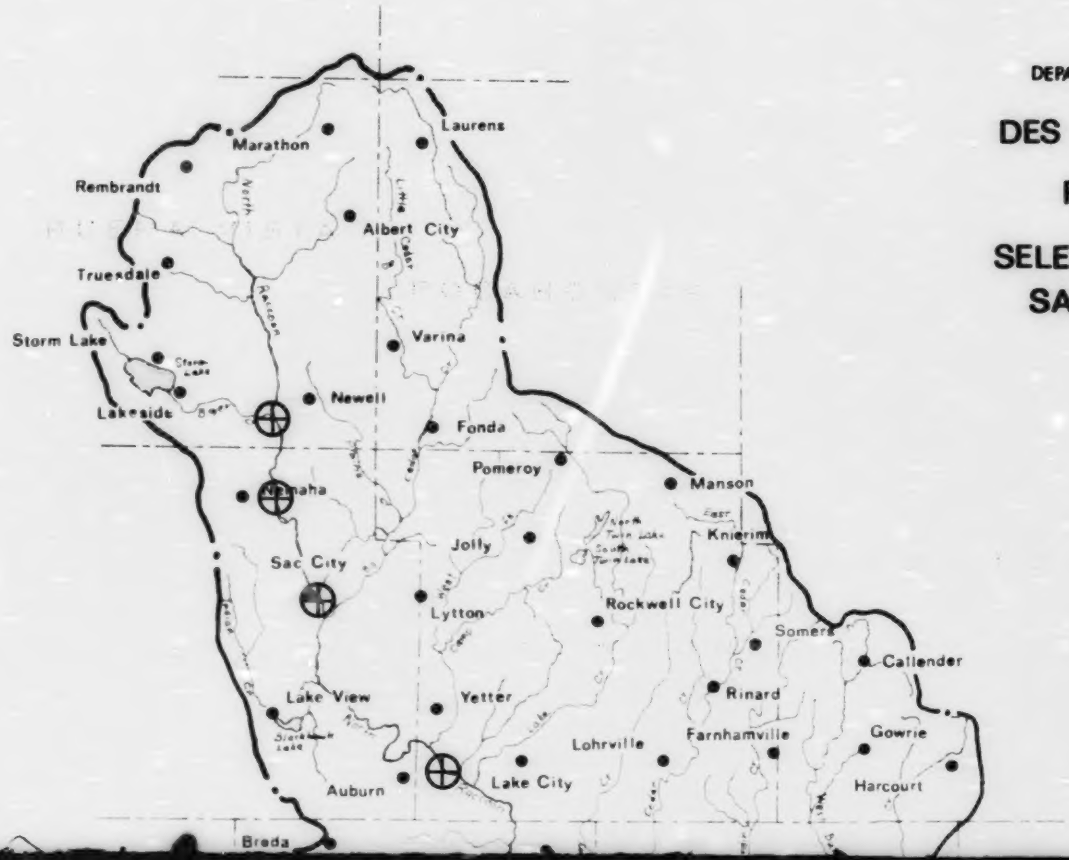
STATE OF IOWA
DEPARTMENT OF ENVIRONMENTAL QUALITY

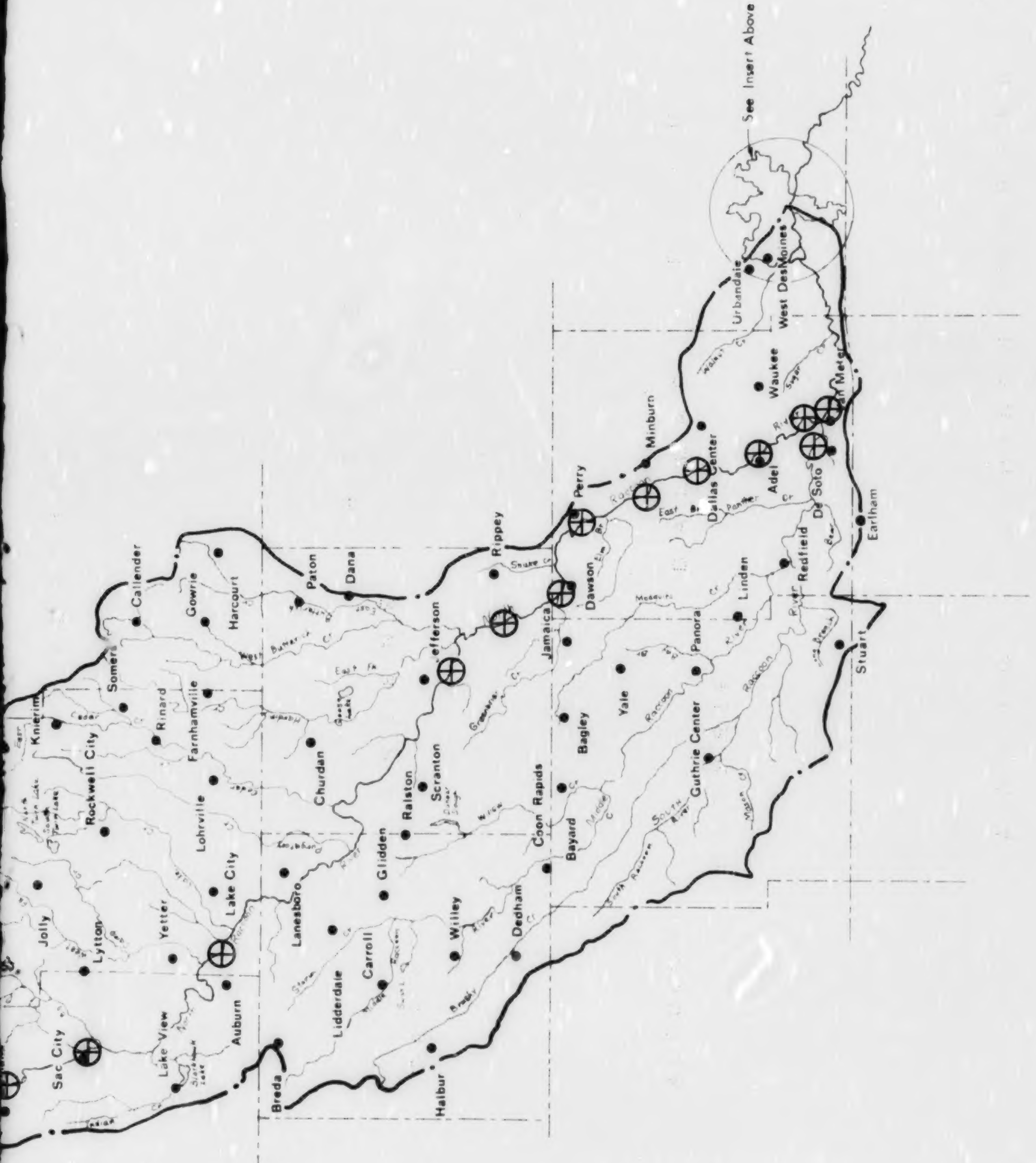
DES MOINES RIVER BASIN

Raccoon Subbasin

SELECTED WATER QUALITY SAMPLING LOCATIONS

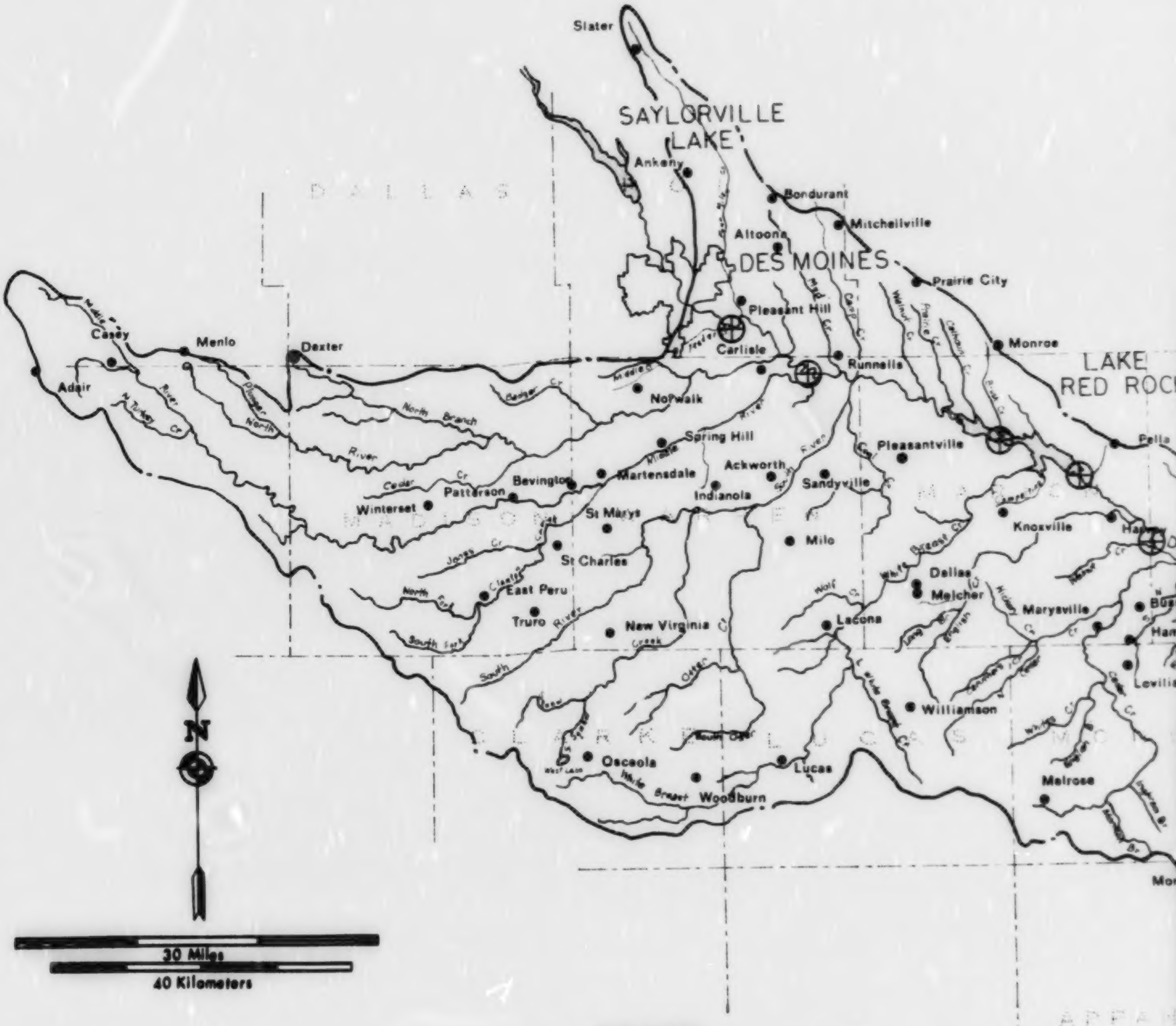

N
30 Miles
40 Kilometers


Laurens
Marathon
Rembrandt
Albert City
Little Cedar
North
Raccoon
Truesdale
Storm Lake
Storm Lake
Varina
Lakeside
Newell
Fonda
Pomeroy
Manson
Newaha
North Twin Lake
South Twin Lake
Knierim
Jolly
Sac City
Lytton
Rockwell City
Somers
Callender
Lake View
Yetter
Rinard
Lohrville
Farnhamville
Gowrie
Auburn
Lake City
Harcourt
Breda


See Insert Above
Urbandale
West Des Moines
Waukee
Van Meter
Minburn
Dallas Center
Adel
De Soto
Earlham
Perry
Rippey
Redfield
Linden
Dawson
Jamaica
Jefferson
Paton
Dana
Callender
Gowrie
Harcourt
Somers
Knierim
Rinard
Farnhamville
Rockwell City
Lohrville
Churdan
Scranton
Ralston
Glidden
Coon Rapids
Bayard
Bagley
Yale
Panora
Guthrie Center
Stuart
Lake City
Lanesboro
Yetter
Lytton
Jolly
Sac City
Lake View
Auburn
Lidderdale
Carroll
Willey
Dedham
Breda
Halbur
Raccoon River
South Raccoon
Middle Raccoon
East Fk
Snake Cr
Panther Cr
Walnut Cr
Sugar Cr
Cedar Cr
Storm Lake

B

FIGURE IV-5


Slater
SAYLORVILLE LAKE
Ankeny
DALLAS
Bondurant
Mitchellville
Altoona
DES MOINES
Prairie City
Pleasant Hill
Carlisle
Monroe
LAKE RED ROC
Runnells
Casey
Menlo
Dexter
Adair
Norwalk
Spring Hill
Pleasantville
Pella
Ackworth
Sandyville
Bevington
Martensdale
Indianola
Winterset
Patterson
MADISON
WARREN
MARION
St Marys
Knoxville
Milo
St Charles
Dallas
Melcher
East Peru
Truro
Marysville
New Virginia
Lacona
Williamson
CLARKE
LUCAS
MONROE
Osceola
Lucas
Woodburn
Melrose
North Branch
River
Middle River
Cedar Cr
South Fork
White Breast Cr
N
30 Miles
40 Kilometers
APPA

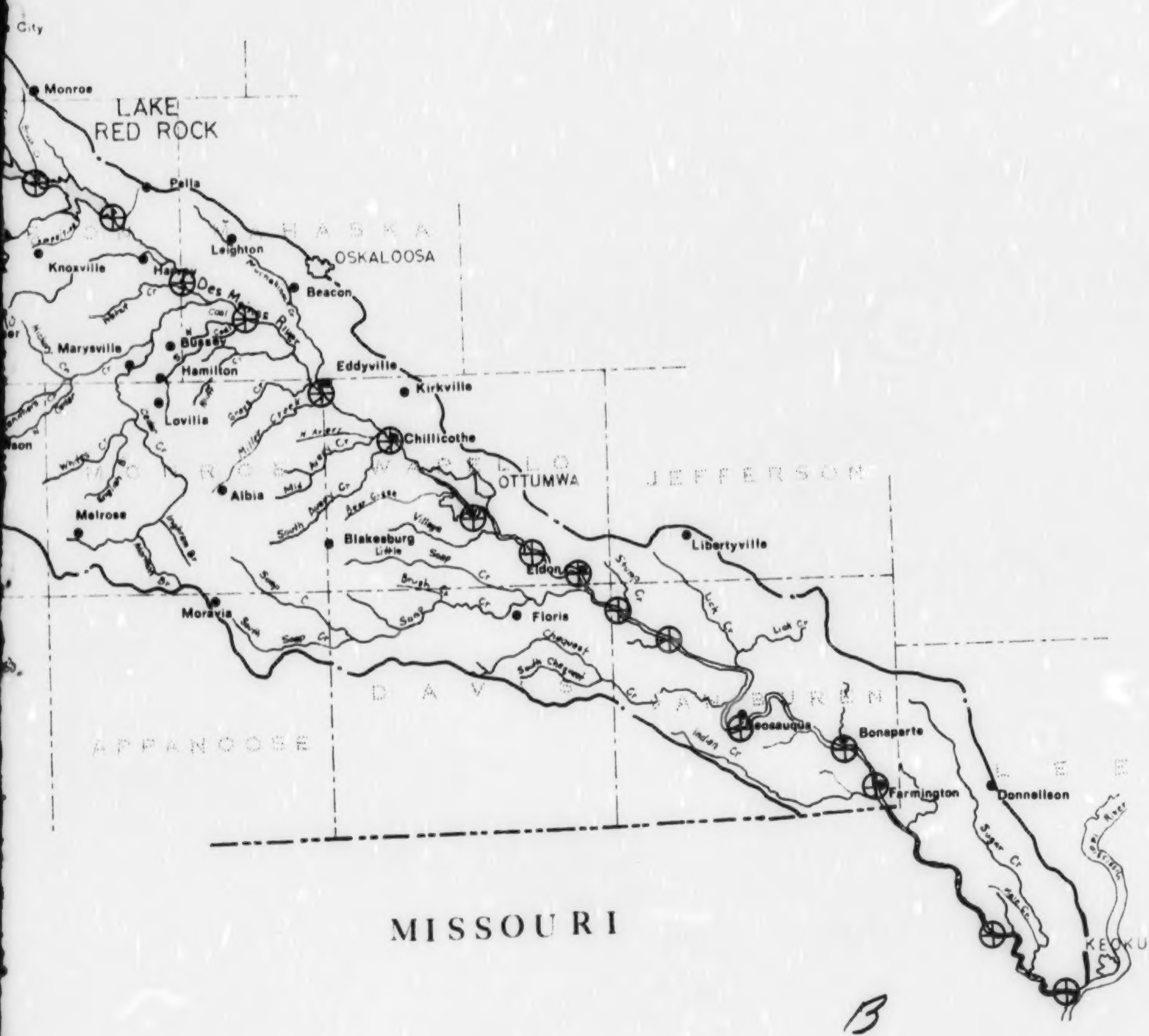
STATE OF IOWA
DEPARTMENT OF ENVIRONMENTAL QUALITY

DES MOINES RIVER BASIN

Lower Des Moines Subbasin

SELECTED WATER QUALITY SAMPLING LOCATIONS

A


City
Monroe
LAKE
RED ROCK
Pella
MAHASKA
Leighton
OSKALOOSA
Knoxville
Des Moines River
Beacon
Marysville
Bussey
Hamilton
Eddyville
Kirkville
Lovilia
Chillicothe
MONROE
WAPELLO
OTTUMWA
JEFFERSON
Albia
Melrose
Blakesburg
Libertyville
Eldon
Moravia
Floris
Lick Cr
Soap Cr
South Chequest
Indian Cr
DAVIS
VAN BUREN
APPANOOSE
Keosauqua
Bonaparte
Farmington
Donnellson
LEE
Sugar Cr
MISSOURI
KEOKUK

B

FIGURE IV-6

DES MOINES RIVER

The most significant types of pollution appear to be physical degradation (related to erosion) and bacteria (below major municipalities). Dissolved oxygen and ammonia concentrations violate Iowa stream standards at times.

Data and Methods

Data collected between Boone and Tracy by Iowa State University provide perhaps the best data available in the State. Data have been collected on the Des Moines River above Des Moines since 1967 and below Des Moines since 1971. Data at other river stations are much less frequent but generally support the Iowa State University studies. For analysis purposes the river is divided into two segments:

> The upper Des Moines River is the first segment and has its beginning at the confluence of the East and West Fork Des Moines near Humboldt and includes the river to Des Moines. This segment has a drainage area of 6,245 square miles.
>
> The lower Des Moines River from Des Moines to the mouth near Keokuk has a drainage area of an additional 8,222 square miles including the largest tributary, the Raccoon River.

Water Quality Conditions

Harmful Substances - The majority of pesticide data collected on the Des Moines River has been collected in the upper segment. Dieldrin has been found in all samples collected. The average concentration of 11 ng/l (parts per trillion) is above the National Academy of Science recommended maximum concentration of 5 ng/l. The maximum concentration found was 50 ng/l. DDE was also found in nearly all samples. The average concentration of DDE was 123 ng/l which is considerably above the recommended maximum of 6 ng/l. The maximum concentration of DDE found was 363 ng/l. Herbicides found include 2,4-D (50 ng/l) and atrazine (739 ng/l average, 2500 ng/l maximum).

Heavy metals found in the upper Des Moines River include barium, lead, manganese, zinc and selenium. No metals in the upper Des Moines were found in violation of Iowa Water Quality Standards. Lead, zinc, and copper have exceeded Iowa standards on the lower Des Moines. The sources of these heavy metals are unknown. Increased surveillance of heavy metals from point sources is recommended to aid in determining the sources.

TABLE IV-2

HEAVY METALS IN THE DES MOINES RIVER

(FORT DODGE - DES MOINES)

PARAMETER	TOTAL SAMPLES	NUMBER OF SAMPLES WITH DETECTABLE LEVELS	MEAN OF THOSE WITH DETECTABLE LEVELS (µg/l)	MAXIMUM (µg/l)
As	2	0		
Ba	4	2	150	200
Cd	4	0		
Cr	6	0		
Cu	4	0		
Pb	4	2	75	80
Mn	2	1	70	70
Hg	2	0		
Ni	2	0		
Ag	0	0		
Zn	4	4	71	160
Se	1	1	2	2

TABLE IV-3

HEAVY METALS IN THE DES MOINES RIVER

(DES MOINES TO KEOKUK)

PARAMETER	TOTAL SAMPLES	NUMBER OF SAMPLES WITH DETECTABLE LEVELS	MEAN OF THOSE WITH DETECTABLE LEVELS (µg/l)	MAXIMUM (µg/l)
As	35	0		
Ba	67	50	262	900
Cd	76	1	30	30
Cr	81	4	22	40
Cu	76	19	35	100
Pb	76	26	308	3200
Mn	9	3	136	200
Hg	17	3	1.3	2
Ni	70	3	80	200
Ag	30	0		
Zn	76	61	125	1300
Se	2	2	2.5	4

TABLE IV-4

PESTICIDES IN THE DES MOINES RIVER

PARAMETER	TOTAL SAMPLES	NUMBER OF SAMPLES WITH DETECTABLE LEVELS	MEAN OF THOSE WITH DETECTABLE LEVELS (ng/l)	MAXIMUM (ng/l)
Aldrin	4			
Chlordane	4			
DDD	4			
DDE	35	32	123	373
DDT	4			
Dieldrin	96	96	11	50
Endrin	4			
Heptachlor Epoxide	4			
Lindane	4			
2, 4-D	4	2	50	50
2, 4, 5-T	4			
Silvex	4			
PCB	3			
Atrazine	35	24	739	2500
Heptachlor	4			

Physical Modification - The major physical modification in the upper Des Moines River is turbidity. Wide fluctuations in turbidity occur depending on runoff conditions. Average turbidity is less than 50 JTU's, but maximum of 800 JTU's has been recorded. These levels are still below concentrations found in some Iowa streams, but may cause an impact on aquatic life. Saylorville Reservoir is currently under construction just north of the City of Des Moines. This will be the final receptacle for a large portion of the suspended solids carried downstream by the river. The reservoir will have the effect of improving the physical quality of the water moving on downstream toward Red Rock Reservoir and the mouth. Turbidity is also a major concern below Des Moines (Figure IV-7).

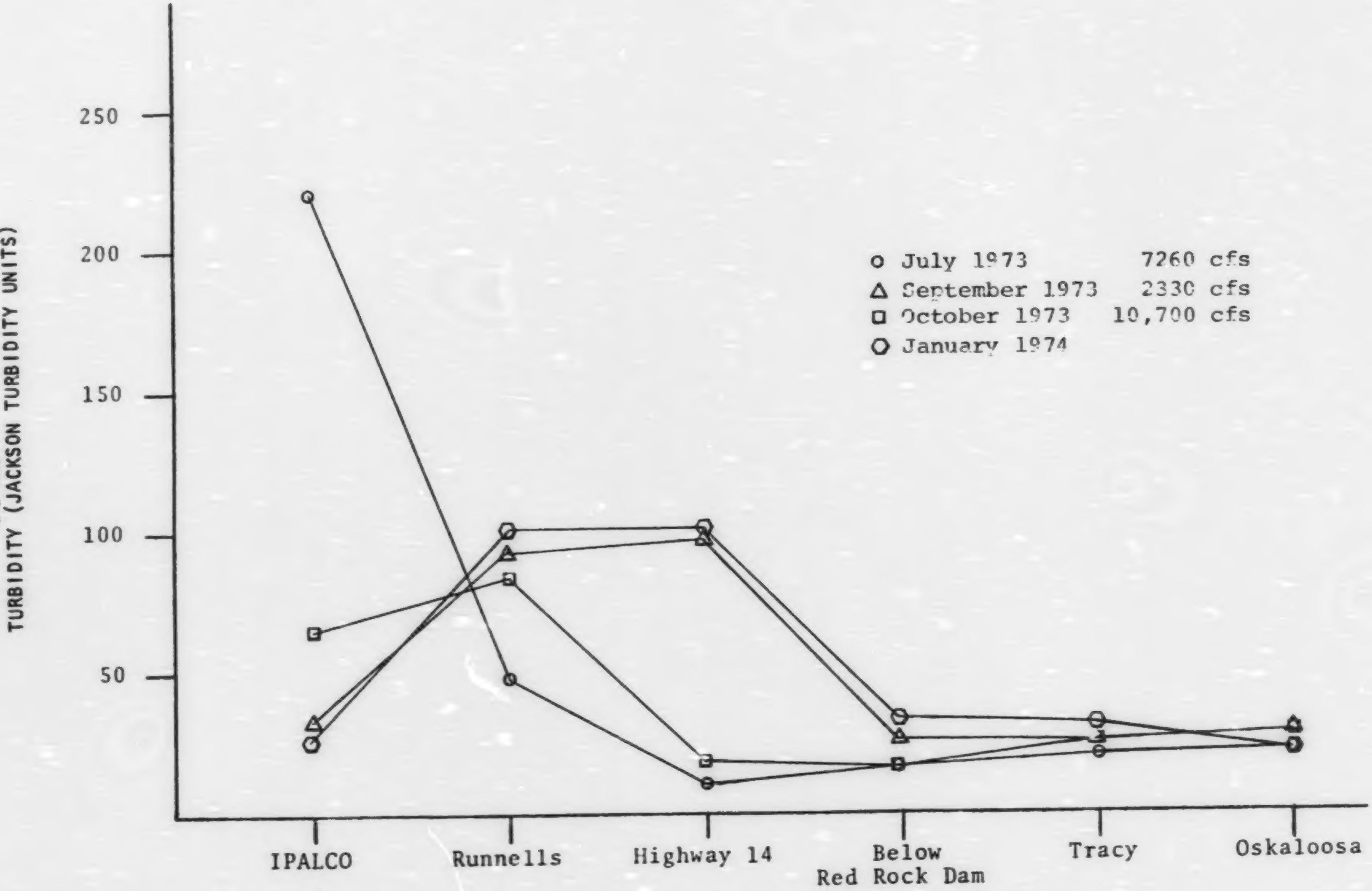


FIGURE IV-7 TURBIDITY PROFILES FOR THE LOWER DES MOINES RIVER

Temperature violations have been found below the power plant at Des Moines (Figure IV-8), and are a potential problem at low flows at other locations on the river. Upon completion of Saylorville Reservoir, flow regulation will decrease the chance of extreme low flow conditions. This might result in fewer temperature problems downstream from the reservoir due to greater dilution.

Oxygen Depletion - Dissolved oxygen and ammonia concentrations have generally been satisfactory in recent years. Considerable improvement in BOD and ammonia concentrations has taken place, particularly in the lower Des Moines River (Figures IV-11 - IV-12). A certain amount of this improvement is undoubtedly the result of high flows causing dilution. The most notable improvement can be shown at Ottumwa where high BOD and ammonia concentrations had been common for over thirty years until the John Morrell Packing Plant closed down.

Low dissolved oxygen levels are still a problem during low flow conditions (Figures IV-9 and IV-10). This is particularly true in the lower Des Moines below the City of Des Moines. Only one dissolved oxygen violation has been found in the upper Des Moines River. Fort Dodge is the main point source on the upper Des Moines. Surveys conducted in the lower Des Moines in 1970 showed dissolved oxygen violations below Des Moines, Iowa. This was the lowest flow period during

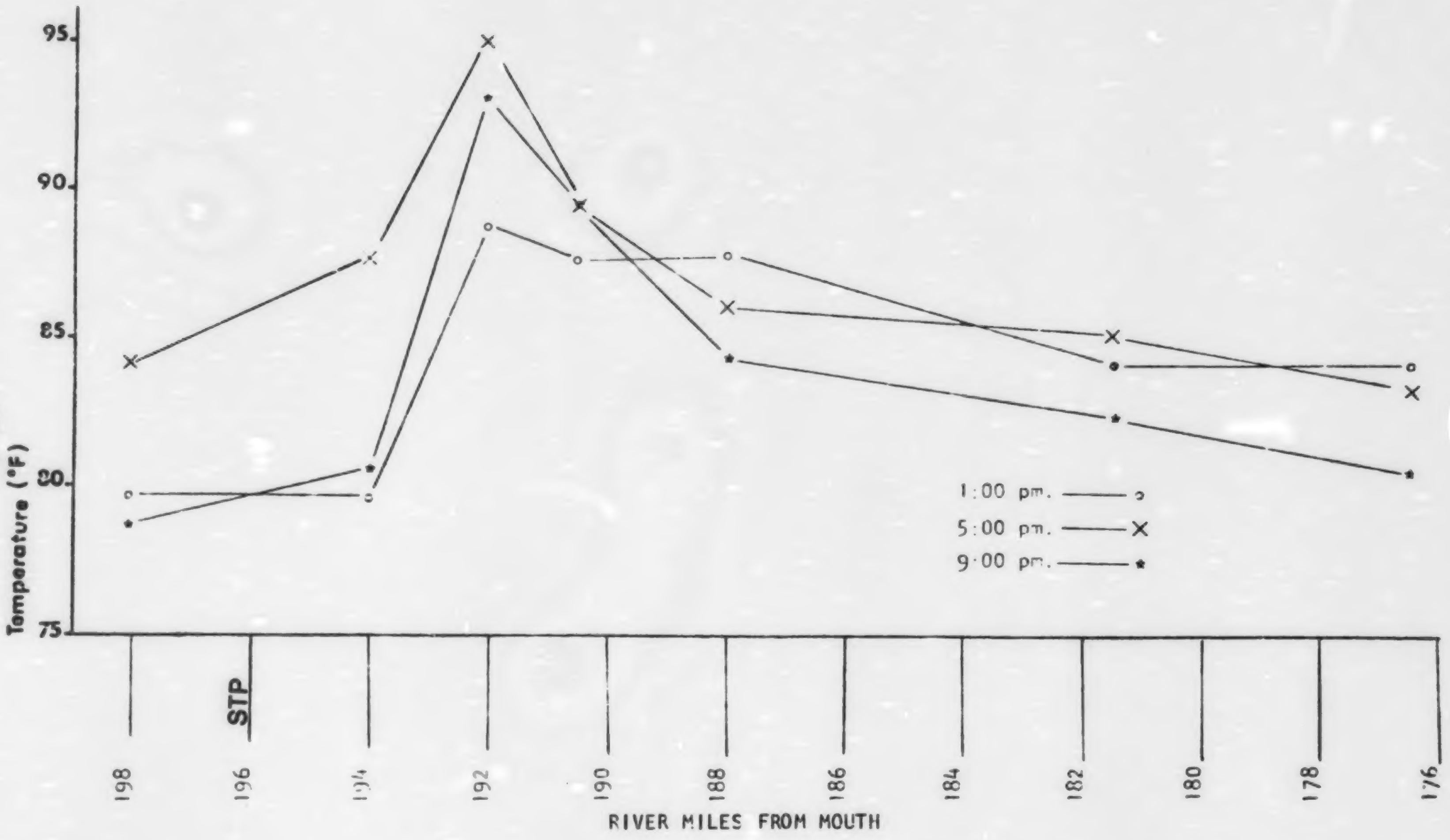


FIGURE IV-8 SEPTEMBER 4, 1970 TEMPERATURE PROFILES FOR THE LOWER DES MOINES RIVER (365 cfs)

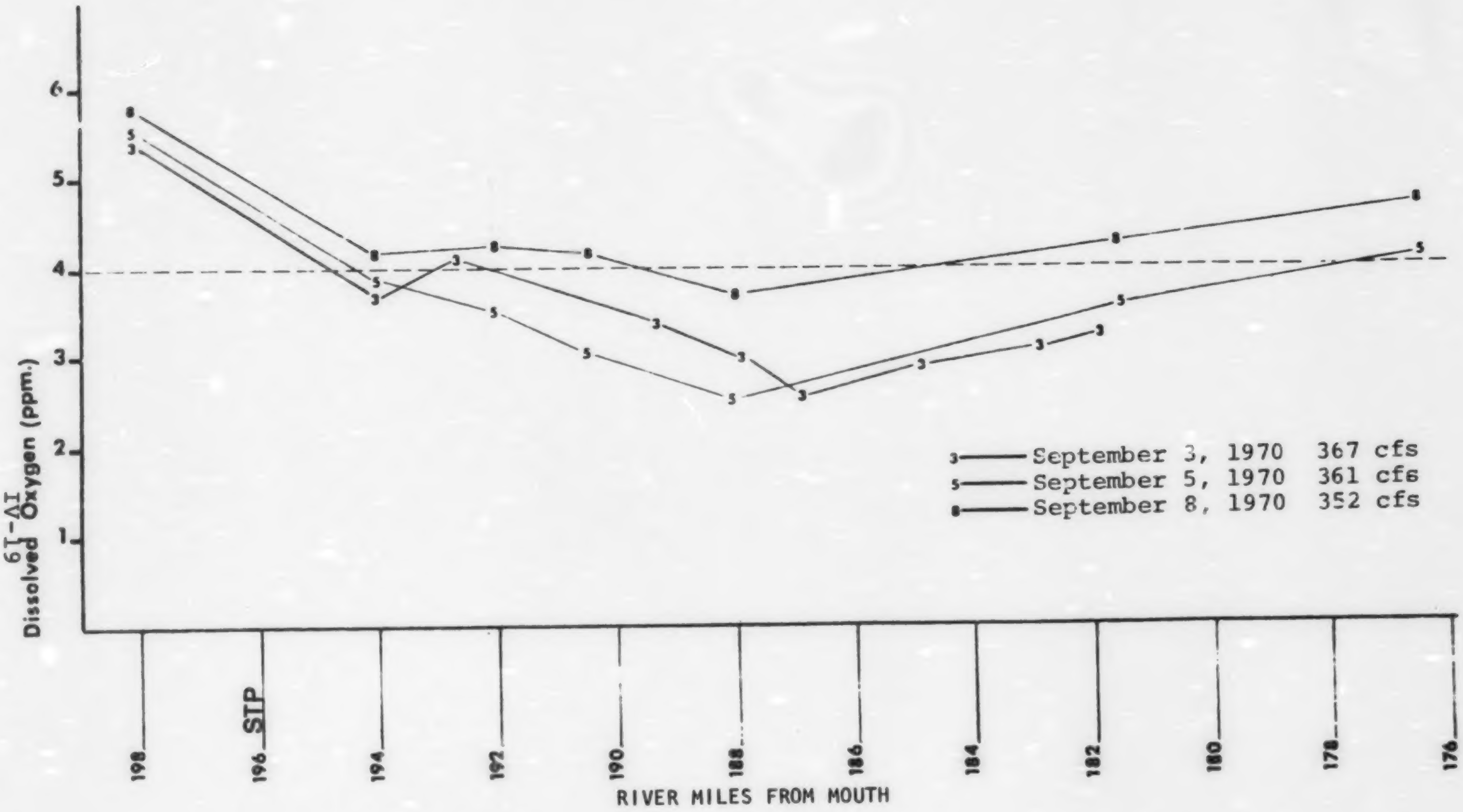


FIGURE IV-9

DISSOLVED OXYGEN PROFILES FOR THE LOWER DES MOINES RIVER

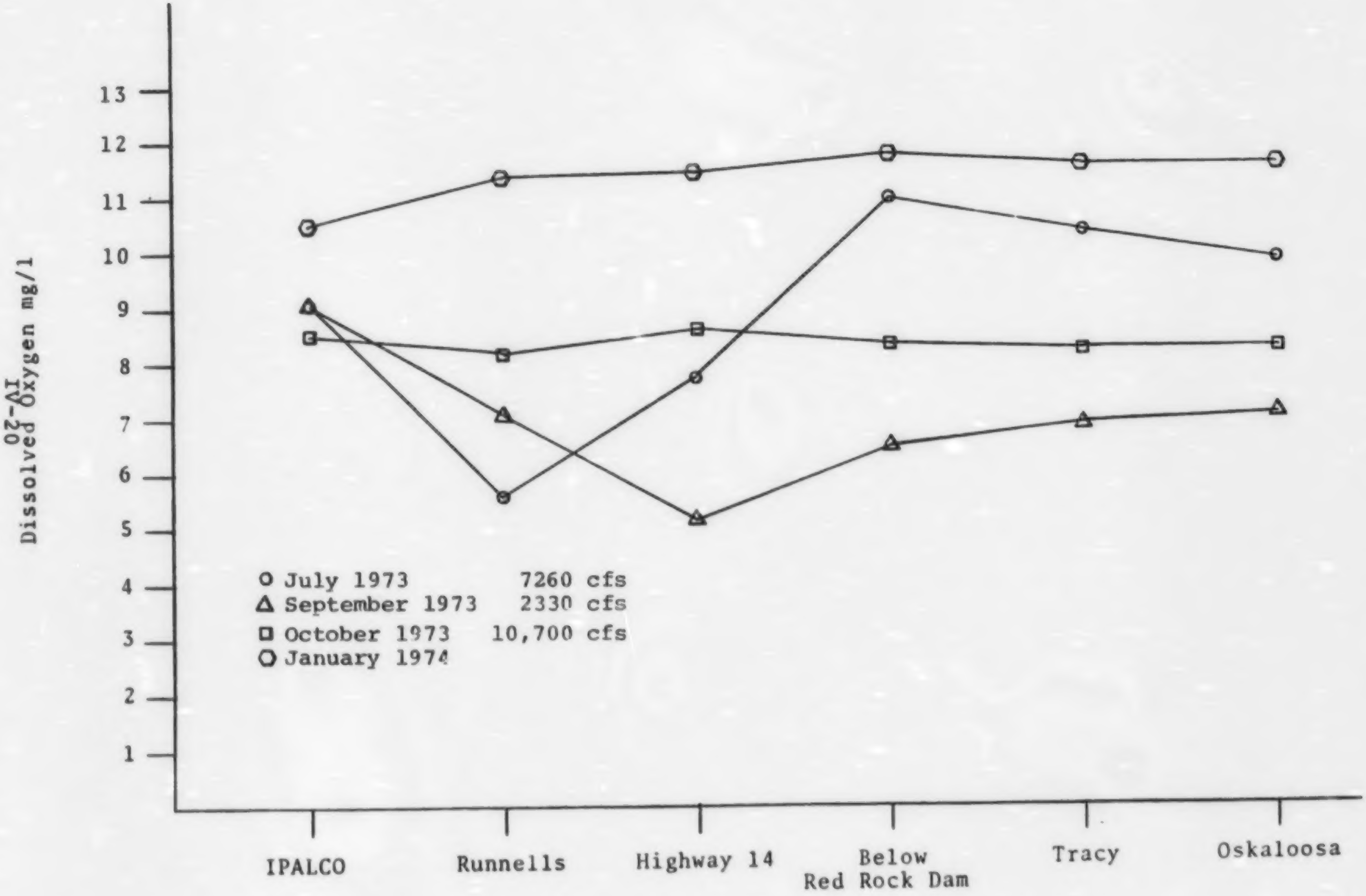


FIGURE IV-10 DISSOLVED OXYGEN PROFILES FOR THE LOWER DES MOINES RIVER

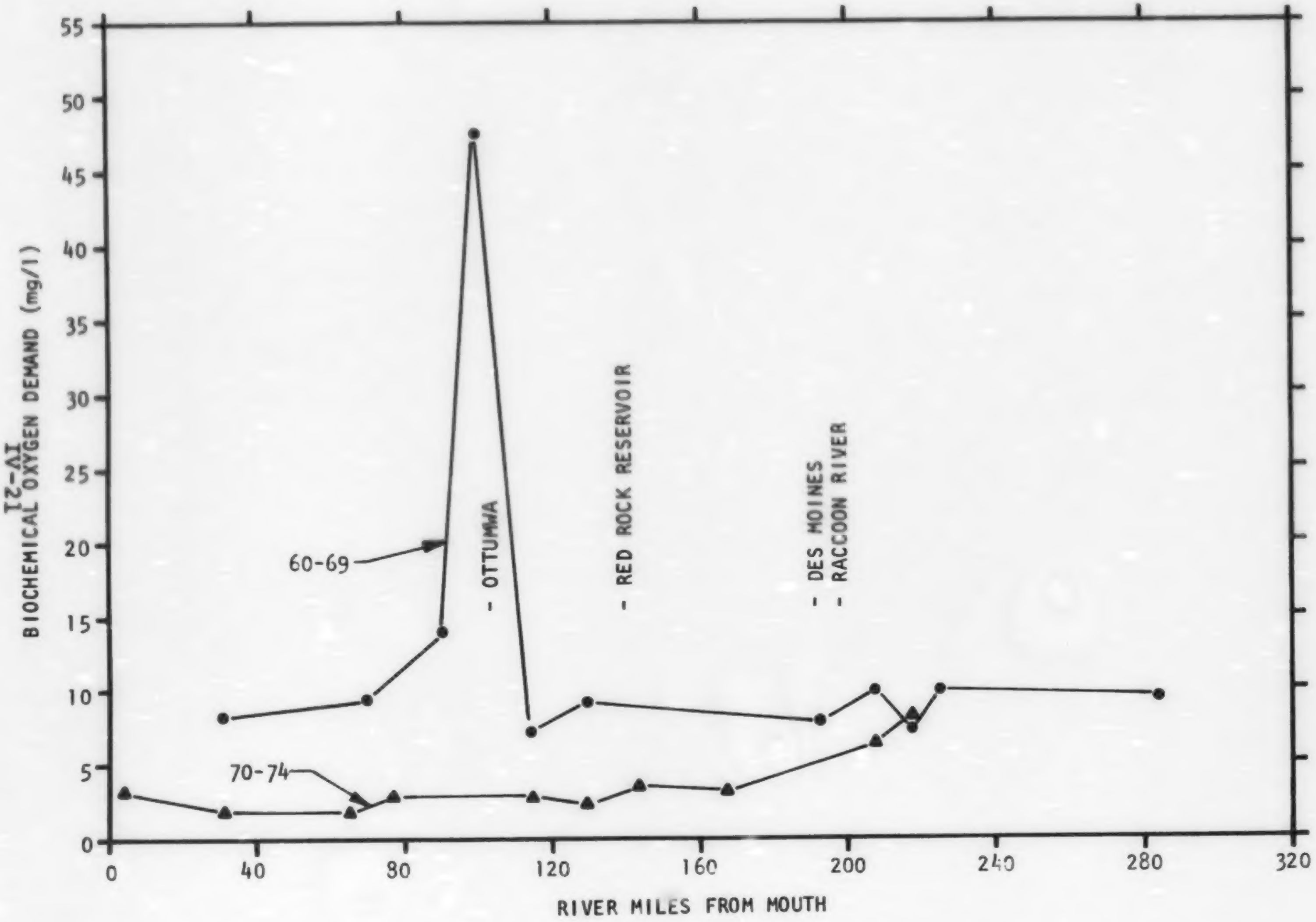


FIGURE IV-11 COMPARISON OF BIOCHEMICAL OXYGEN DEMAND IN THE DES MOINES RIVER, 1960's vs 1970's

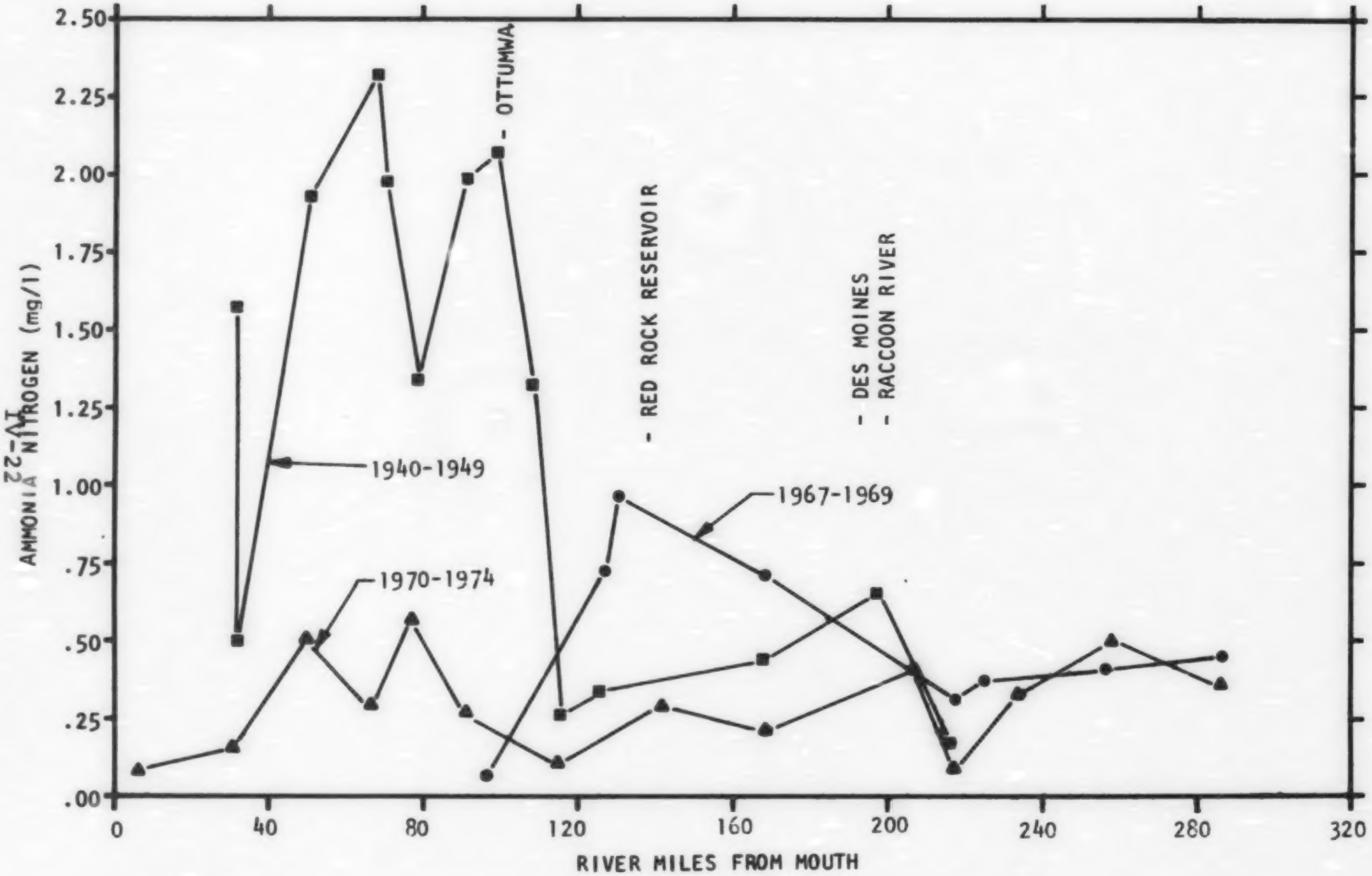


FIGURE IV-12 COMPARISON OF AMMONIA NITROGEN CONCENTRATIONS IN THE DES MOINES RIVER, 1940's vs 1960's vs 1970's.

the last several years. Even during recent high flow periods the oxygen sag can be seen below Des Moines. While there have been few recent dissolved oxygen violations, the potential exists, during low flow, for violations on many streams of Iowa standards for dissolved oxygen.

Ammonia violations have occurred with equal frequency in both the upper and lower Des Moines since 1970. They have been more widespread than dissolved oxygen violations. In general ammonia concentrations have decreased in the Des Moines River during recent years. Again, dilution is a factor. The closing of the John Morrell plant at Ottumwa has also improved water quality. Des Moines continues to cause some ammonia violations in the lower Des Moines. The widely scattered nature of ammonia violations on the upper Des Moines suggests that nonpoint runoff is responsible for these high concentrations. All of the violations were well below point sources.

BOD concentrations in the upper Des Moines River are generally higher in the Lower Des Moines (Figure IV-13). BOD concentrations would be expected to increase slightly below the City of Des Moines due to the large point source. Instead concentrations decrease slightly below Des Moines. This must be the result of the large dilution volume of the Raccoon River which not only dilutes the City of Des Moines' discharge but lowers the BOD concentration of the Des Moines River (Figure IV-13). At low flows the Raccoon River pro-

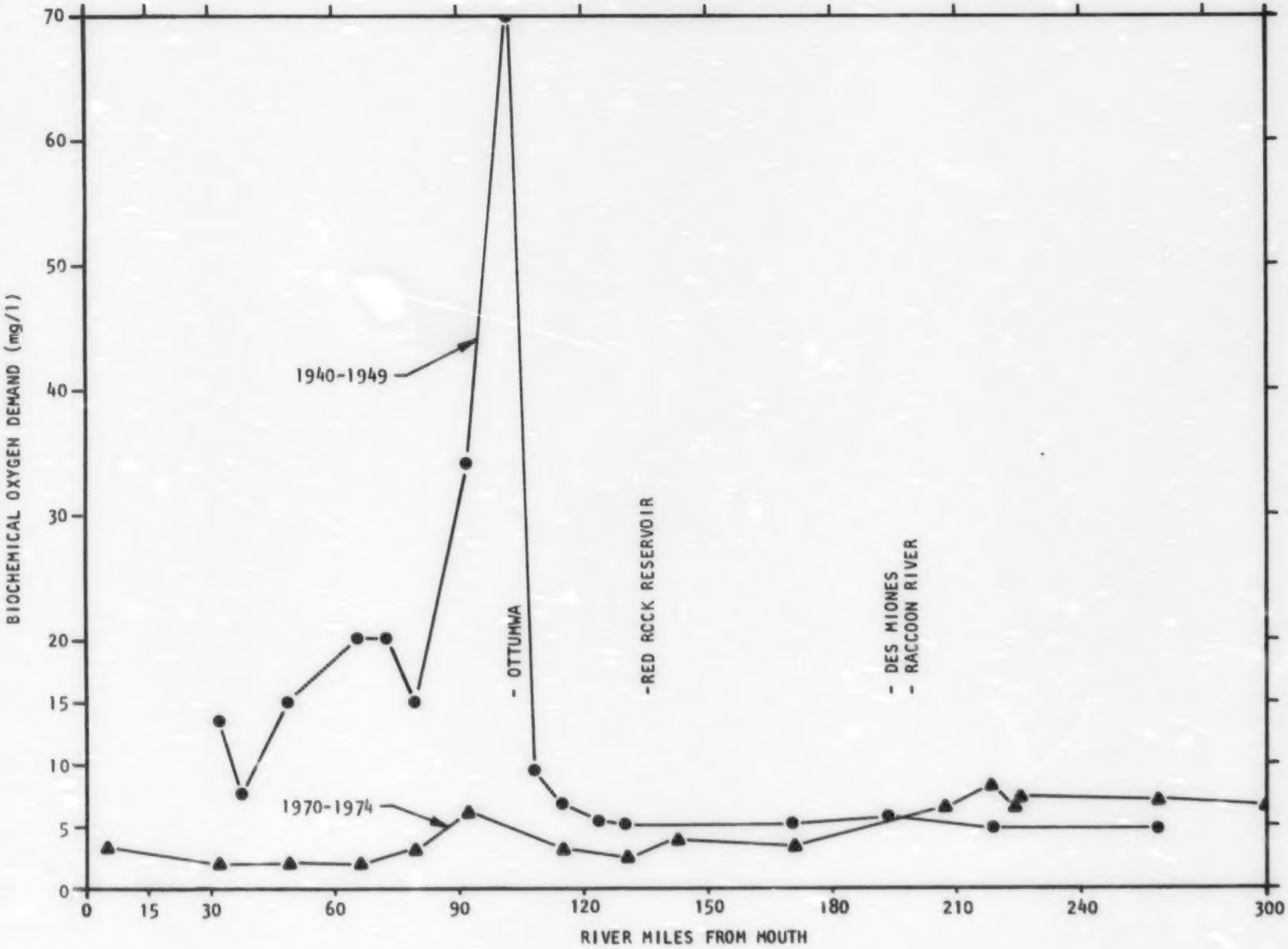
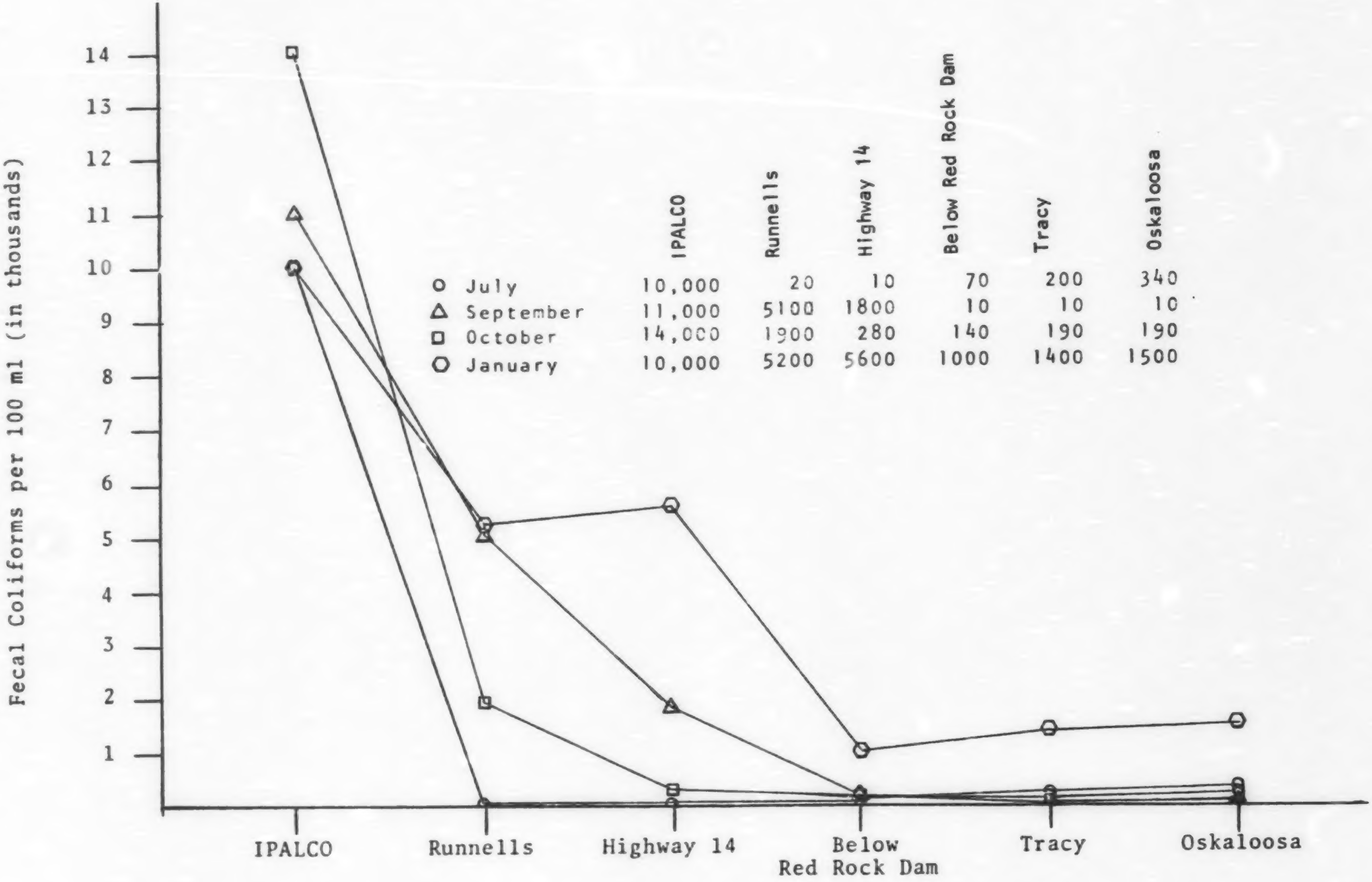


FIGURE IV-13 COMPARISON OF MEAN BIOCHEMICAL OXYGEN DEMAND CONCENTRATIONS FOR THE DES MOINES RIVER, 1940's vs 1970's

vides a smaller percentage of total flow to the Des Moines River and has lesser dilutional effect. This, in part, is the reason dissolved oxygen problems are only seen at low flows. The BOD concentration also decreases slightly below Red Rock Reservoir. The reservoir has a cleansing effect and removes large amounts of turbidity and BOD from the river. A small peak in BOD is again found at Ottumwa. While much lower than previous years (Figure IV-12), it continues to affect stream quality, even at higher flows. No dissolved oxygen violations have been found below Ottumwa in recent years, but only limited sampling has taken place.

Health Hazards and Aesthetic Degradation - Fecal coliform concentrations are generally in excess of the 200/100 ml criteria established by the EPA. In spite of chlorination by major municipalities discharging to the river, concentrations increase markedly below discharges (Figure IV-14). This indicates violations of Iowa standards. Due to the high background concentrations from nonpoint sources, there is little improvement that will be produced by further lowering concentrations from point sources.



	IPALCO	Runnells	Highway 14	Below Red Rock Dam	Tracy	Oskaloosa
o July	10,000	20	10	70	200	340
△ September	11,000	5100	1800	10	10	10
□ October	14,000	1900	280	140	190	190
⬡ January	10,000	5200	5600	1000	1400	1500

FIGURE IV-14 FECAL COLIFORM PROFILES FOR THE LOWER DES MOINES RIVER

EAST FORK DES MOINES RIVER

Water quality in the East Fork Des Moines River is generally better than in the West Fork Des Moines River. With few exceptions, dissolved oxygen and ammonia have not violated Iowa Water Quality Standards. The East Fork Des Moines River has fewer and smaller point source discharges than the West Fork. The only point source to show appreciable impact on the stream is Algona, the largest city on the East Fork.

Water Quality Conditions

Harmful Substances - Heavy metals found in the East Fork Des Moines River include barium, copper, lead, manganese, and zinc. The highest lead concentration has been only 0.07 mg/l which is below the 0.10 mg/l standard. Since there are no known point sources that contribute metals on the East Fork Des Moines River it is assumed that the metal concentrations found are the result of nonpoint sources.

Physical Modification - Turbidity, solids and temperature levels in the East Fork Des Moines River are similar to those found in the West Fork. There is no information to suggest that there is significant physical modification.

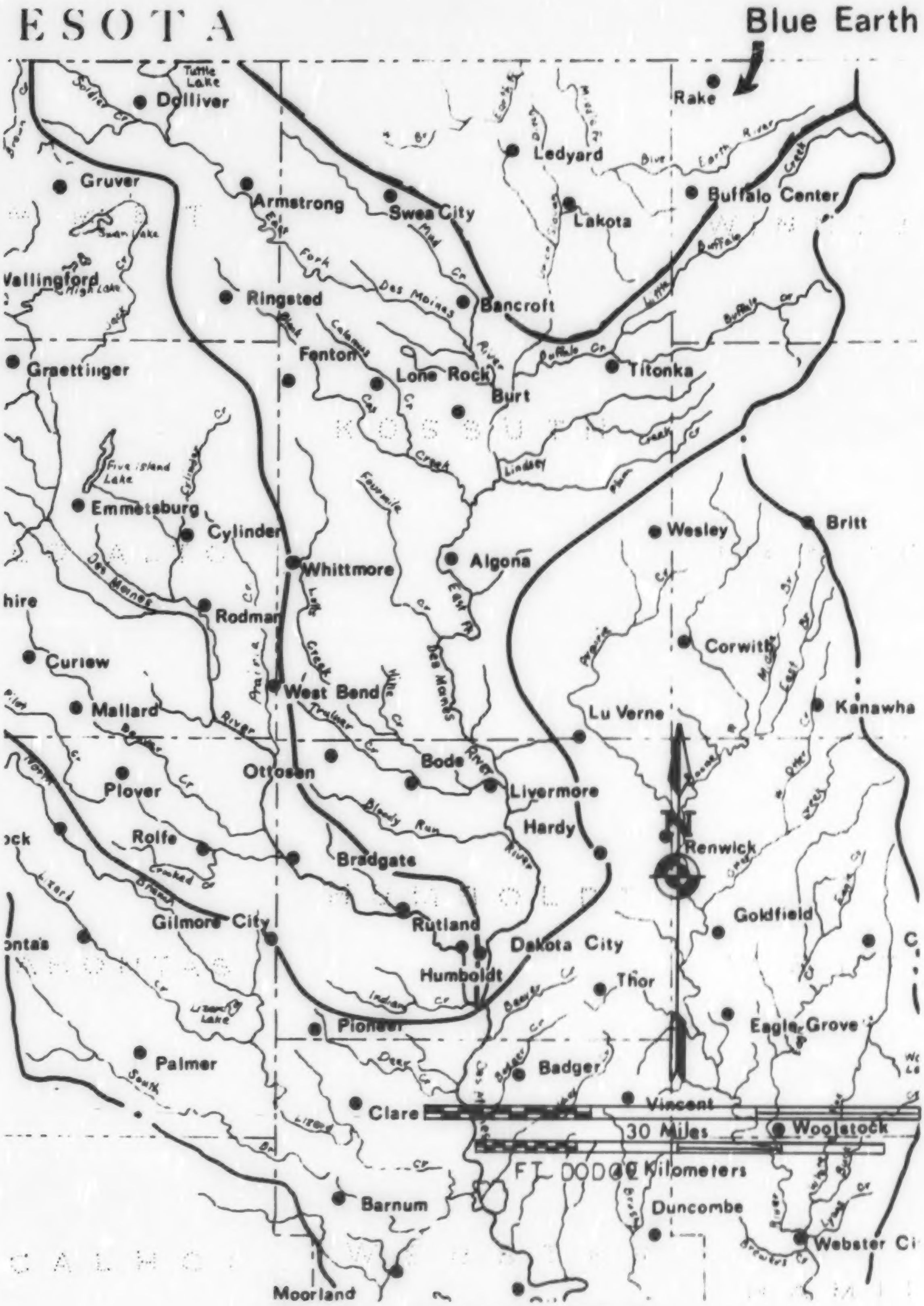

ESOTA
Blue Earth
Tuttle Lake
Dolliver
Rake
Ledyard
Gruver
Armstrong
Swea City
Lakota
Buffalo Center
Blue Earth River
Swan Lake
Wallingford
High Lake
Ringsted
Bancroft
East Fork Des Moines River
Mud Cr
Buffalo Cr
Graettinger
Fenton
Lone Rock
Burt
Titonka
KOSSUTH
Cat Creek
Lindsey Creek
Plum Creek
Five Island Lake
Cylinder Cr
Emmetsburg
Cylinder
Fourmile
Britt
Wesley
Whittmore
Algona
Des Moines
hire
Rodman
East Fk
Curlew
Corwith
Lotts Creek
Prairie
West Bend
Mallard
Lu Verne
Kanawha
Des Moines River
Trainer Cr
Ottosen
Bode
Livermore
Plover
Bloody Run
Hardy
N
Renwick
ock
Rolfe
Crooked Cr
Bradgate
Goldfield
Gilmore City
Rutland
Dakota City
ontas
Humboldt
Thor
Indian Cr
Eagle Grove
Pioneer
Palmer
Badger
Deer Cr
Clare
Vincent
30 Miles
Woolstock
FT. DODGE
Kilometers
Barnum
Duncombe
Webster Ci
Boone River
Brewers Cr
CALHO
Moorland

FIGURE IV-15 EAST DES MOINES RIVER BASIN

TABLE IV-5

HEAVY METALS IN THE EAST FORK DES MOINES RIVER

PARAMETER	TOTAL SAMPLES	NUMBER OF SAMPLES WITH DETECTABLE LEVELS	MEAN OF THOSE WITH DETECTABLE LEVELS (ug/l)	MAXIMUM (ug/l)
As	11	0		
Ba	10	8	125	200
Cd	13	0		
Cr	13	0		
Cu	13	1	10	10
Pb	13	2	65	70
Mn	8	5	308	570
Hg	0	0		
Ni	12	0		
Ag	7	0		
Zn	13	11	67	

Oxygen Depletion - Dissolved oxygen concentrations have been adequate during most sampling periods. In January, 1970, samples collected at three locations all showed dissolved oxygen (DO) concentrations below 5.0 mg/l. It is difficult to determine what the cause of this low dissolved oxygen was since the DO at Armstrong near the Minnesota border was already 3 mg/l. The DO seemed to recover slightly by Algona, but decreased slightly again below Algona (Figure IV-16). On other occasions dissolved oxygen conditions have been very good. Only two dissolved oxygen violations, those noted above, and one ammonia violation have been found on the East Fork Des Moines River.

The oxygen and ammonia concentrations are much better than in previous periods. Data sufficient for comparison is

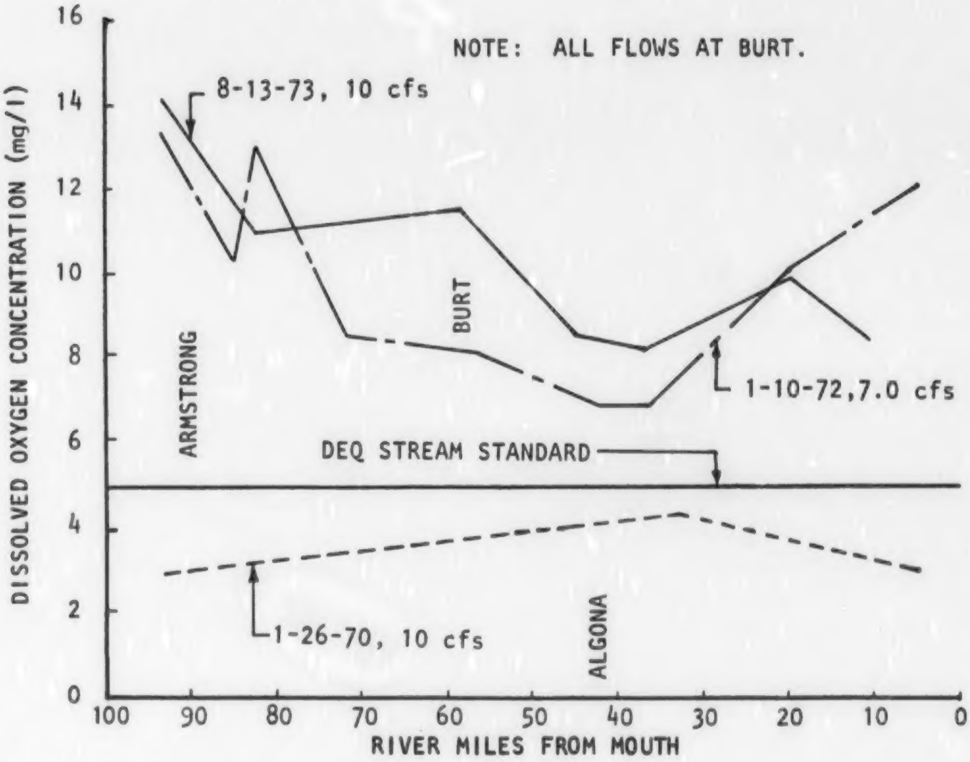


FIGURE IV-16 EAST FORK DES MOINES RIVER, DISSOLVED OXYGEN CONCENTRATION

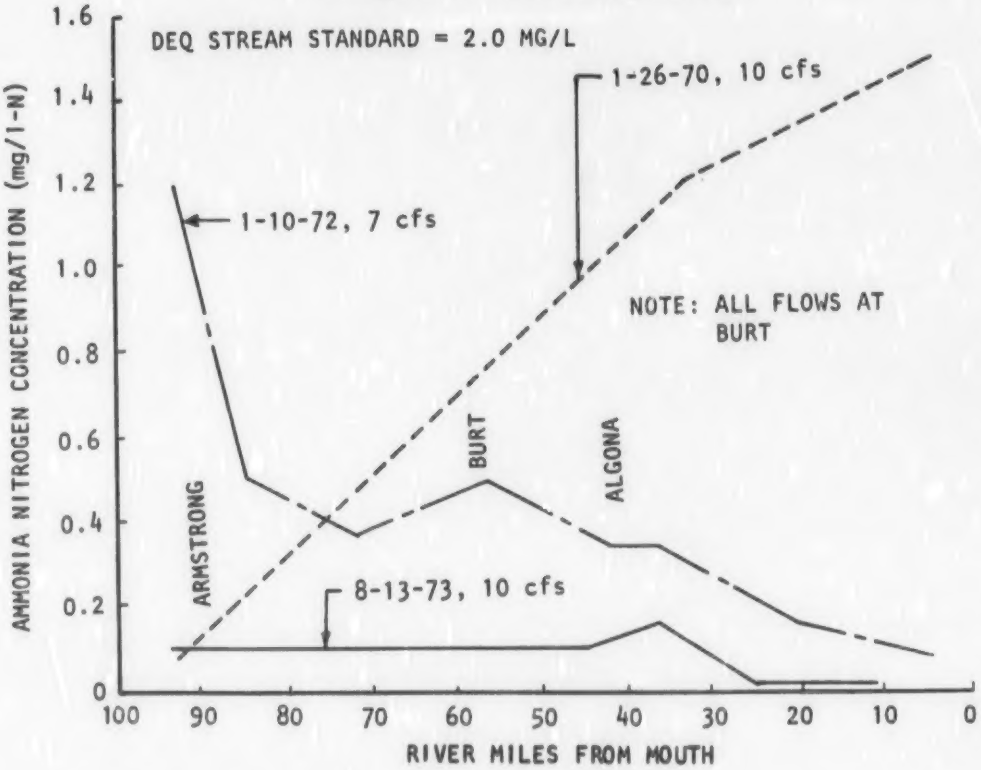


FIGURE IV-17 EAST FORK DES MOINES RIVER, AMMONIA NITROGEN CONCENTRATION

available only for the 1940's. During that 10 year period dissolved oxygen violations occurred in over 35% of the samples collected. Ammonia violations occurred in 8% of the samples. These figures are significantly higher than data for the past four years. Considerable improvement has occurred in the water quality of the East Fork Des Moines River since the 1940's.

Health Hazards and Aesthetic Degradation - Fecal coliform levels are low compared to the West Fork. This is due in part to the number of point sources, as well as the relatively small size of the municipalities. Fecal coliform concentrations do increase during runoff periods.

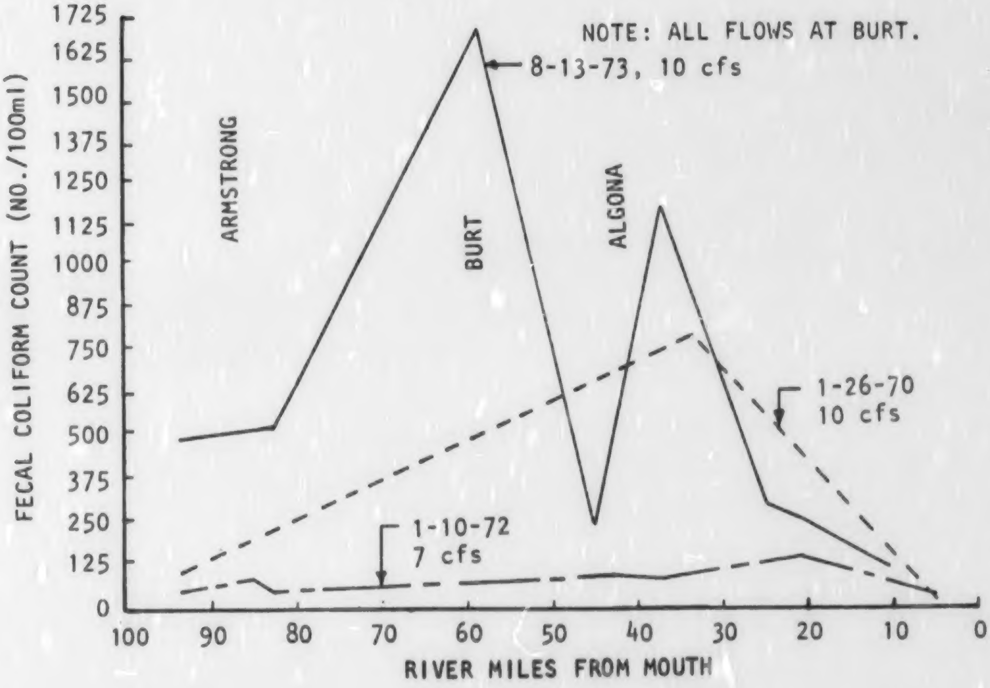


FIGURE IV-18 EAST FORK DES MOINES RIVER, FECAL COLIFORM COUNT

WEST FORK DES MOINES RIVER

Water quality in the West Fork Des Moines River is generally good. Exceptions to this occur during winter and low flow conditions when point sources cause a greater impact on the stream. Water quality is generally poorer below the communities of Estherville, Emmetsburg, and Humboldt.

Pollution Problems and Sources

Wastes from the three largest municipalities affect water quality along the West Fork Des Moines River. Serious problems with high ammonia concentrations and low dissolved oxygen levels exist during the winter and low flow periods. A significant bacteriological impact is also made by these point sources.

Nonpoint sources also affect stream quality. Various researchers have shown that during periods of storm runoff increases in the concentrations of phosphorus, nitrogen, dissolved solids, and fecal coliform counts occur even though additional dilution water is present. Although these trends seem to be indicated by existing data, no correlation between rainfall and changes in water quality parameters are possible due to the limited data available.

Water Quality Conditions

Harmful Substances - Heavy metals found in the West Fork Des Moines River include barium, copper, lead, manganese and zinc. Of these, only manganese exceeds recommended drinking

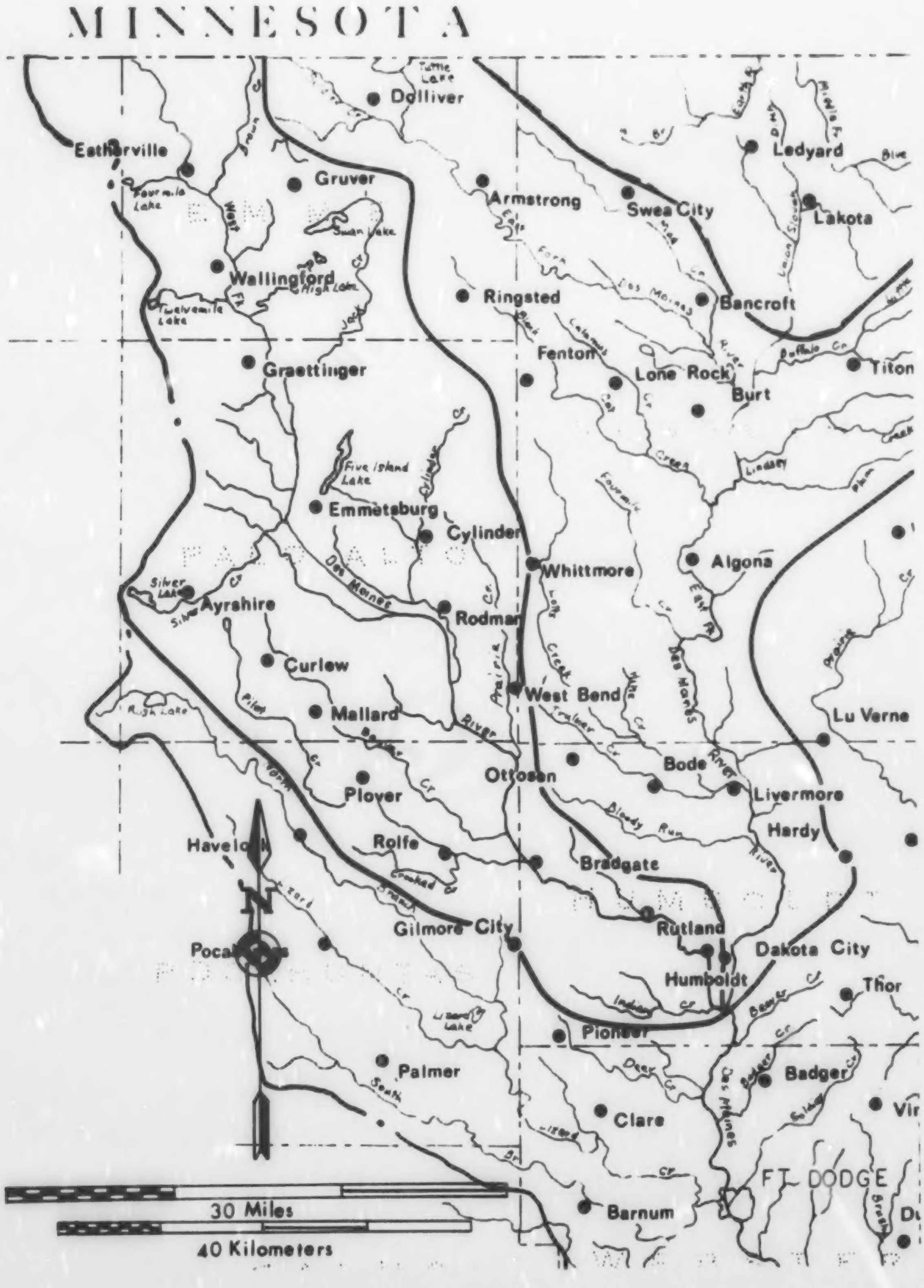

MINNESOTA
Turtle Lake
Dolliver
Estherville
Gruver
Fourmile Lake
Swan Lake
Wallingford
High Lake
Twelvemile Lake
Graettinger
Five Island Lake
Emmetsburg
Cylinder
Silver Lake
Ayrshire
Curlew
Mallard
Rush Lake
Plover
Havelock
Rolfe
Pocahontas
Gilmore City
Palmer
Lizard Lake
Armstrong
Swea City
Ledyard
Lakota
Ringsted
Bancroft
Fenton
Lone Rock
Burt
Titon
Whittmore
Algona
Rodman
West Bend
Lu Verne
Ottosen
Bode
Livermore
Hardy
Bradgate
Rutland
Dakota City
Humboldt
Thor
Pioneer
Badger
Clare
Barnum
FT. DODGE
Des Moines River
East Fork
Lindsey Cr.
Bloody Run
Indian Cr.
Crooked Cr.
N
30 Miles
40 Kilometers

FIGURE IV-19 WEST DES MOINES RIVER BASIN

water standards. Manganese standards have been established by the EPA for surface water supplies. This level was exceeded in 85% of the samples collected in the West Fork. No municipalities use the West Fork as a surface water supply. Manganese is not toxic and would not be a health hazard. Lead concentrations in the West Fork have not exceeded Iowa Water Quality Standards in the samples analyzed. There are no known point sources of heavy metals on the West Fork. Manganese concentrations are therefore assumed to be due to nonpoint sources.

TABLE IV-6

HEAVY METALS IN THE WEST FORK DES MOINES RIVER

PARAMETER	TOTAL SAMPLES	NUMBER OF SAMPLES WITH DETECTABLE LEVELS	MEAN OF THOSE WITH DETECTABLE LEVELS (µg/l)	MAXIMUM (µg/l)
As	11	0		
Ba	11	9	144	200
Cd	12	0		
Cr	14	0		
Cu	12	2	10	10
Pb	12	4	65	130
Mn	7	6	283	510
Hg	2	0		
Ni	10	0		
Ag	6	0		
Zn	12	10	57	210

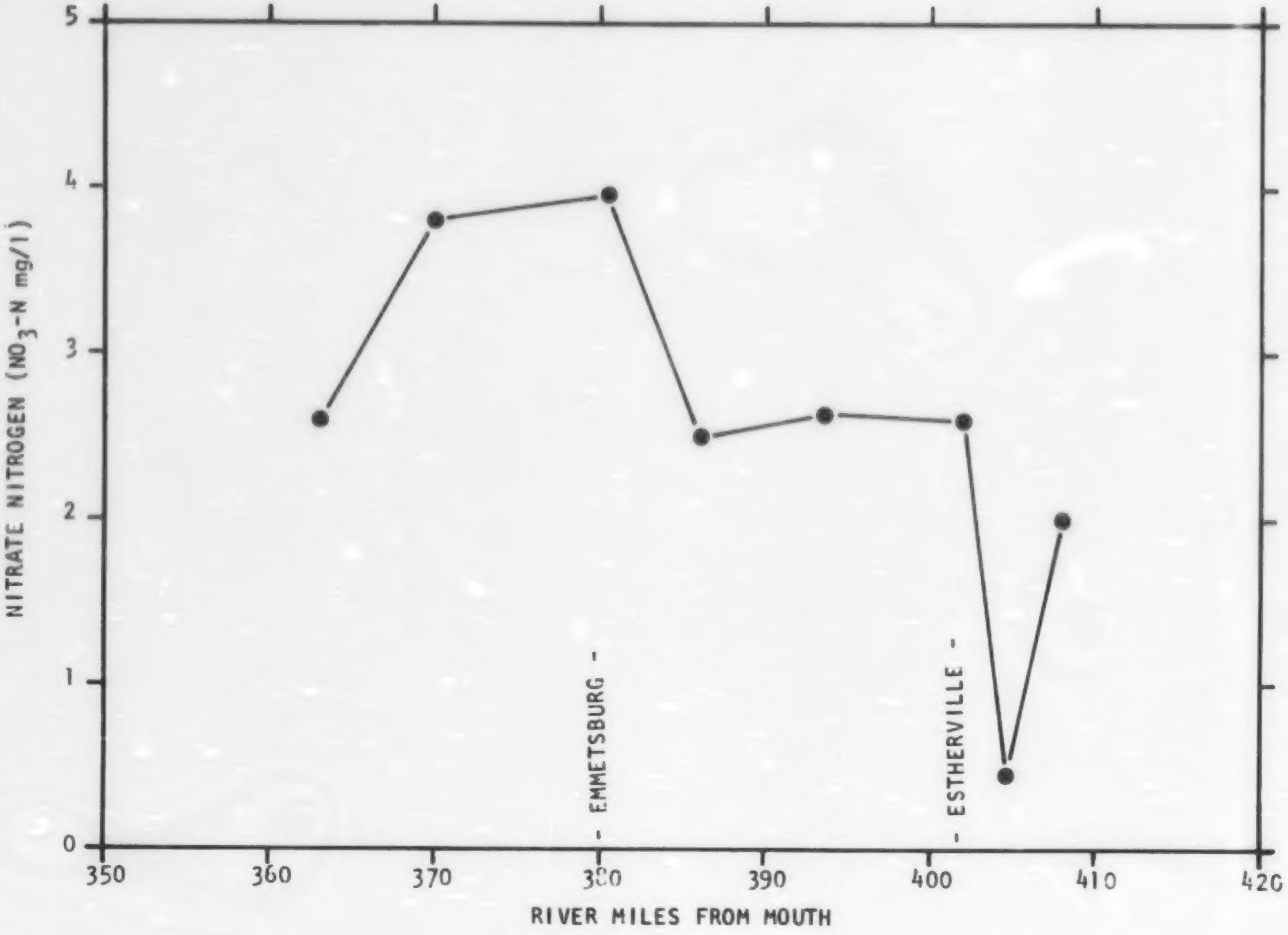


FIGURE IV-20 MEAN NITRATE NITROGEN CONCENTRATIONS IN THE WEST FORK DES MOINES RIVER, 1970-1974

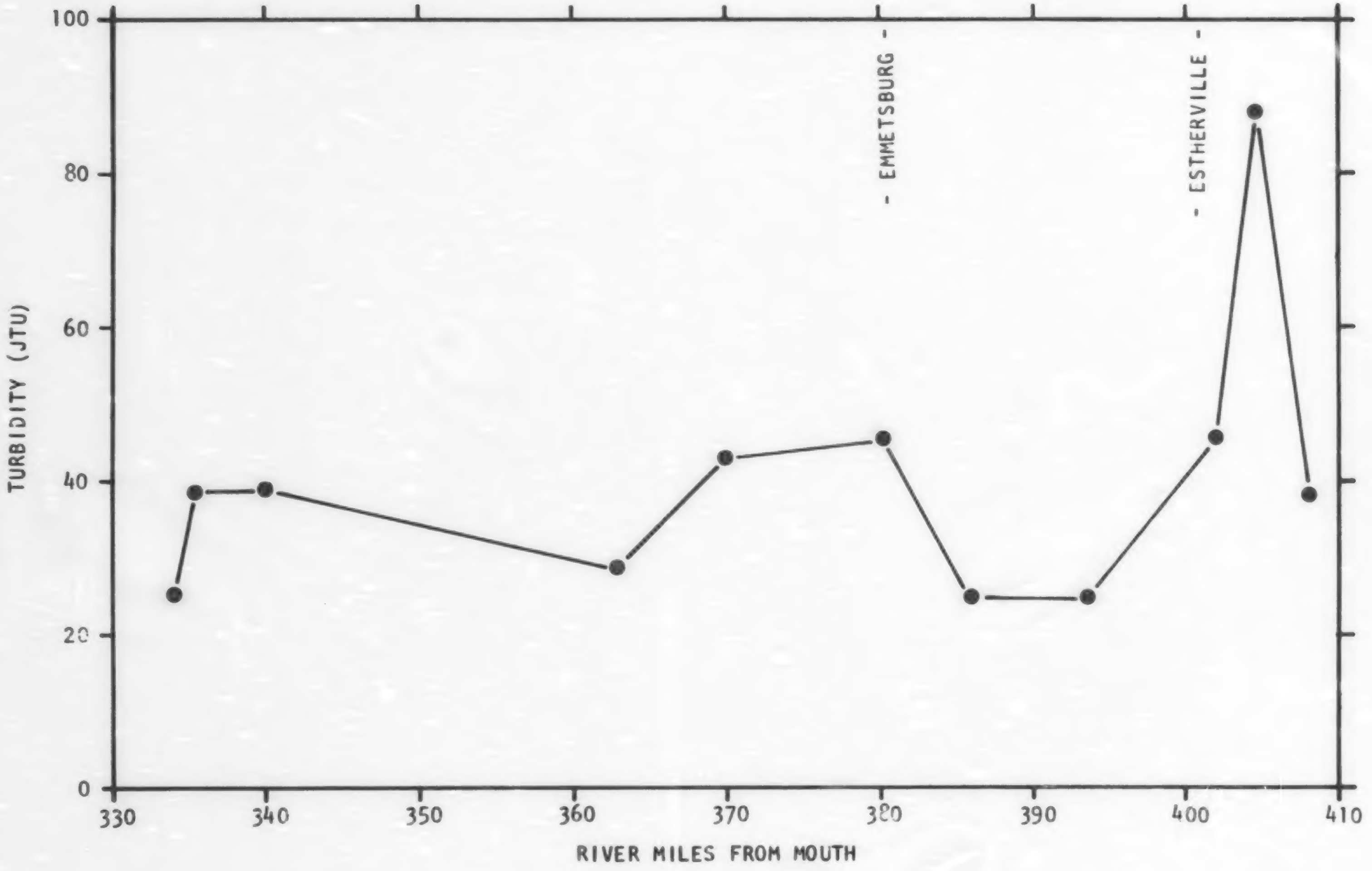


FIGURE IV-21 MEAN TURBIDITY CONCENTRATIONS IN THE WEST FORK DES MOINES RIVER, 1970-1974

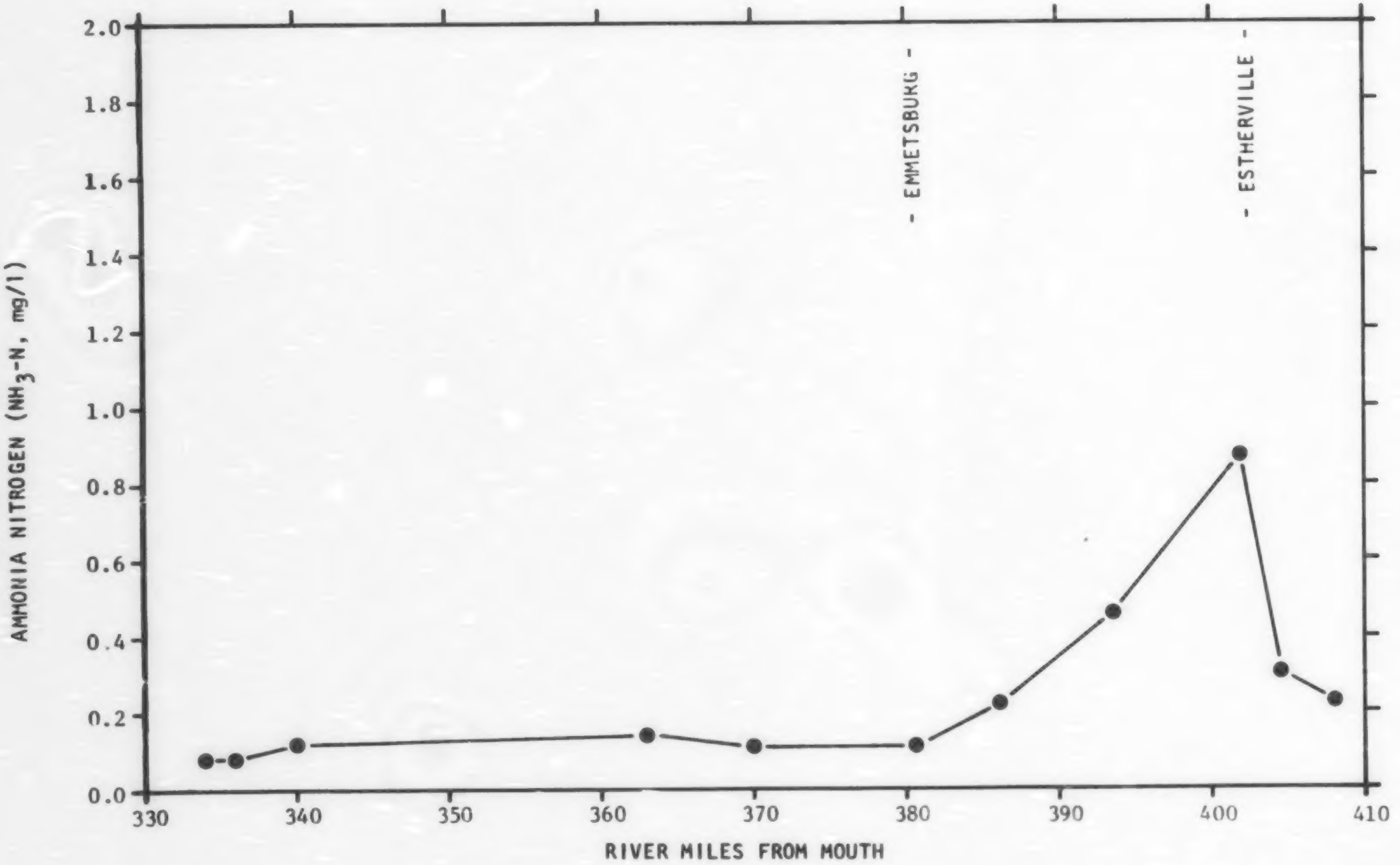


FIGURE IV-22 MEAN AMMONIA NITROGEN CONCENTRATIONS IN THE WEST FORK DES MOINES RIVER, 1970-1974

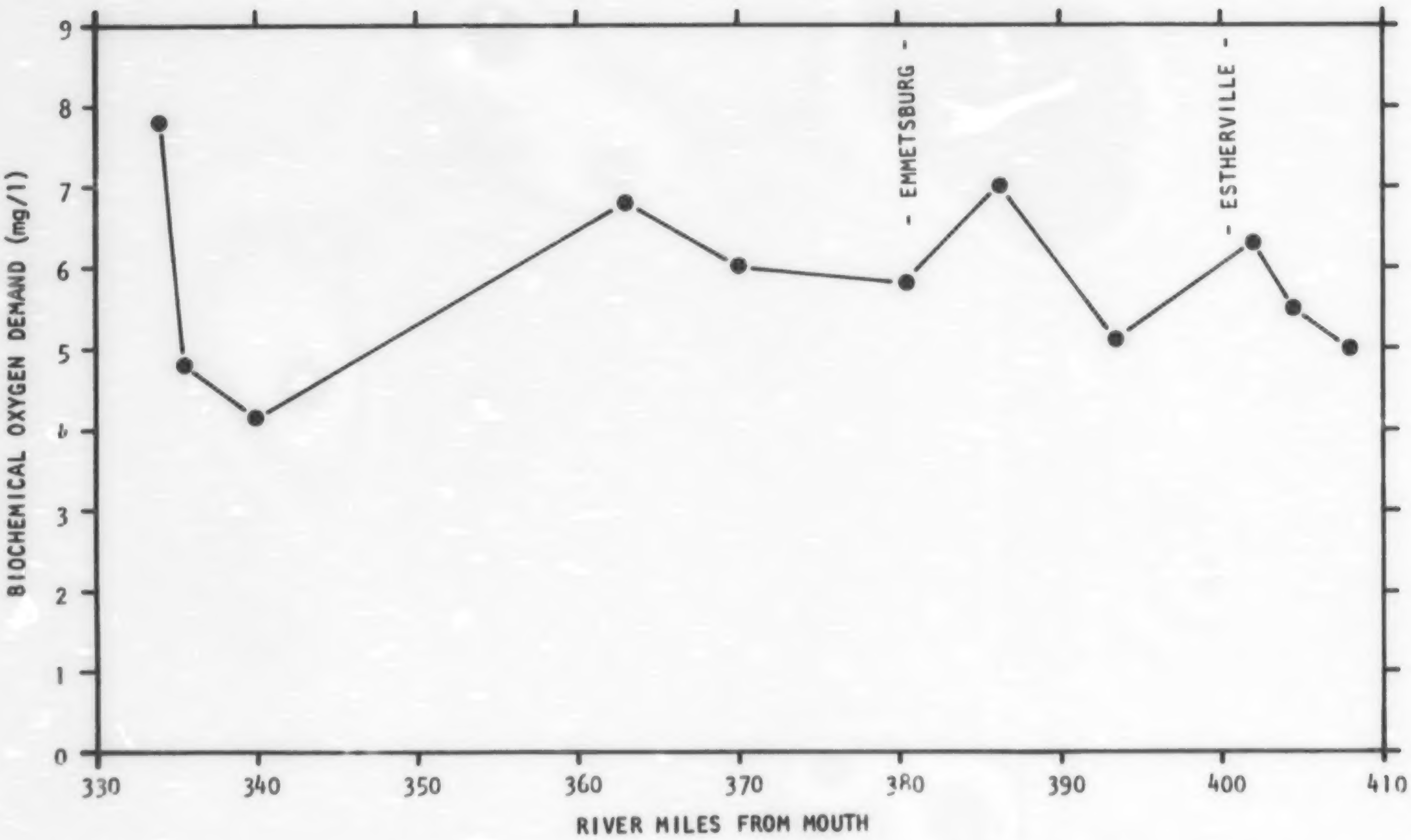


FIGURE IV-23 MEAN BIOCHEMICAL OXYGEN DEMAND IN THE WEST FORK DES MOINES RIVER, 1970-1974

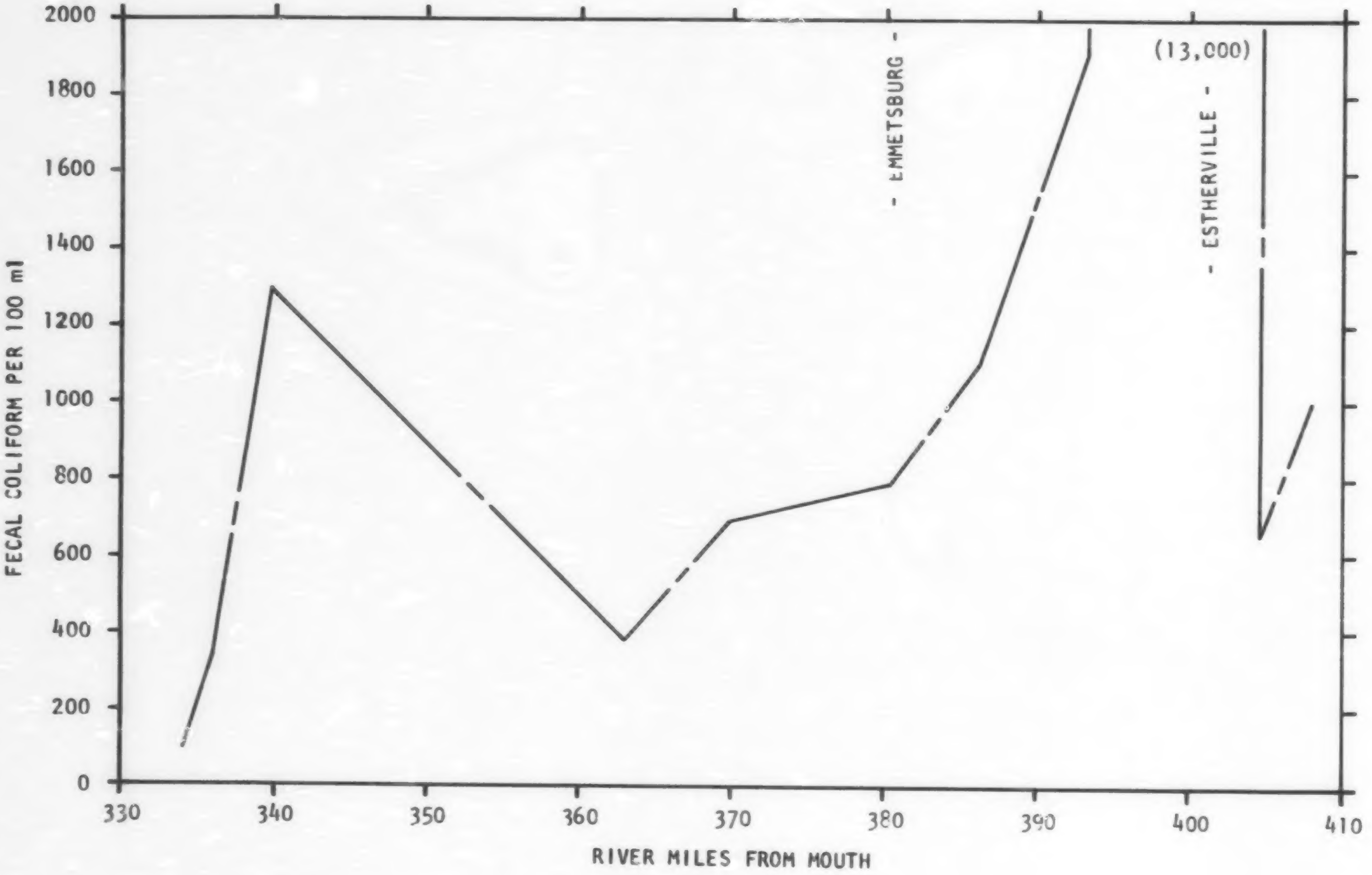


FIGURE IV-24 MEAN FECAL COLIFORM CONCENTRATIONS IN THE WEST FORK DES MOINES RIVER, 1970-1974

Physical Modification - Turbidity and solids levels increase during storm runoff periods. Concentrations are typical of most Iowa streams during runoff and are not critical. In general, the physical condition of the West Fork is good.

Oxygen Depletion - Sampling on the West Fork Des Moines has been conducted at time of critical stream flows and during ice cover conditions in the past several years to determine violations of Iowa Water Quality Standards. Data in 1970 at a stream flow of 21 cfs showed dissolved oxygen concentrations below 5 mg/l at all stations along the river. One location showed a concentration below 4.0 mg/l, the minimum dissolved oxygen standard established by Iowa. Two locations below Estherville showed violations of the 2.0 mg/l ammonia standard.

Surveys conducted in 1972 and 1973 also showed dissolved oxygen and ammonia violations (Figure IV-25, Figure IV-26). On the basis of over 150 samples for dissolved oxygen and over 100 samples for ammonia since 1970, 12% have violated Iowa dissolved oxygen standards and 3% have violated Iowa ammonia standards.

While dissolved oxygen and ammonia concentrations are the most significant pollution problems on the West Fork there have been improvements. Comparisons with data collected in the 1940's indicate improvement not only in the average dissolved oxygen and ammonia concentrations, but also in

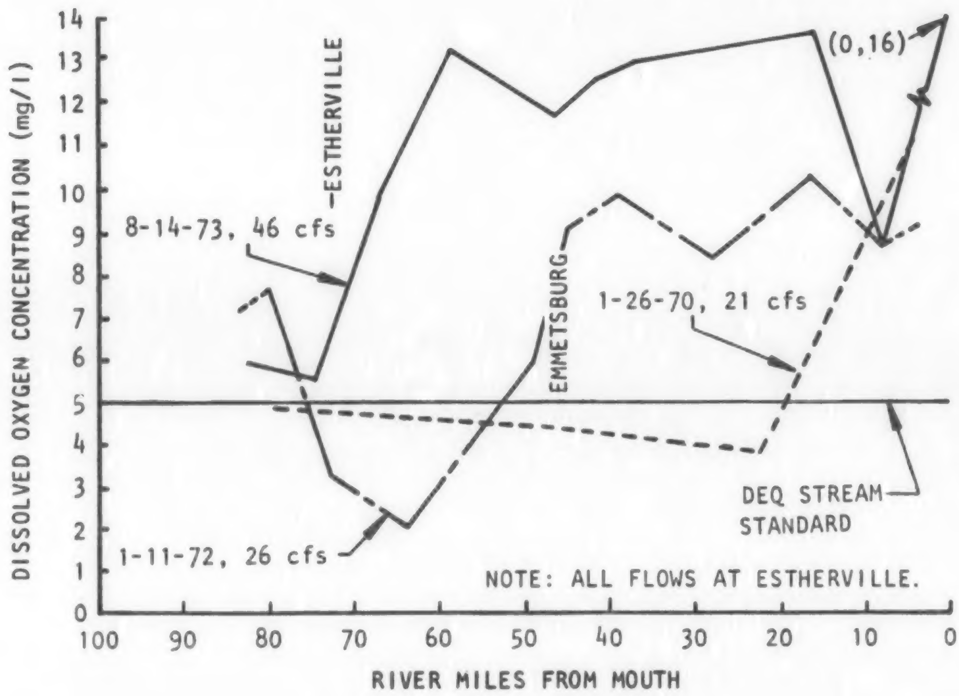


FIGURE IV-25 WEST FORK DES MOINES RIVER, DISSOLVED OXYGEN CONCENTRATIONS

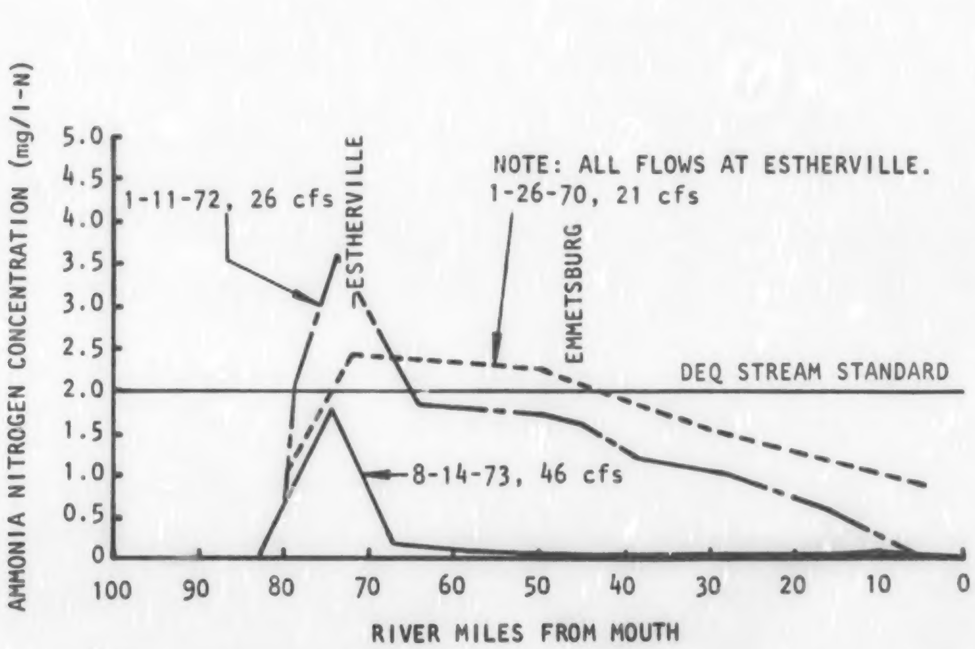


FIGURE IV-26 WEST FORK DES MOINES RIVER, AMMONIA NITROGEN CONCENTRATIONS

the percent violations for these parameters. Violations of dissolved oxygen and ammonia standards were 32% and 25% respectively for samples collected from 1940-1949. While no water quality standards existed at that time, current water quality standards were used for comparative purposes.

Health Hazards and Aesthetic Degradation - Fecal coliform counts generally exceed the 200/100 ml standard for contact recreation established by the EPA. Background levels found above Estherville are considerably above this level (Figure IV-26).

Peaks for fecal coliform occur below the major cities and can be found in both summer and winter. Runoff causes the general background level of fecal coliform to increase significantly.

TABLE IV-7

WATER QUALITY IOWA-MINNESOTA BORDER 1967-1973

WATER QUALITY PARAMETER	NUMBER OF DETERMINATIONS	AVERAGE VALUE	HIGH VALUE	LOW VALUE
West Fork Des Moines River[1]				
Dissolved Oxygen (mg/1)	30	9.40	17.00	3.80
5-Day BOD (mg/1)	43	6.00	12.00	1.50
pH (unit)	43	7.80	8.80	7.30
Turbidity (JTU)	43	30.80	100.00	0.04
Conductivity (micromho)	43	762.00	1,200.00	210.00
Total Solids (mg/1)	38	718.00	1,300.00	65.00
Total Non-filterable Solids (mg/1)	43	64.00	390.00	3.00
Ammonia Nitrogen (mg/1-N)	43	0.30	1.30	0.05
Nitrate Nitrogen (mg/1-N)	43	1.20	6.00	0.02
Total Phosphorus (mg/1-P)	43	0.31	1.00	0.10
Fecal Coliforms (No./100 ml)	43	2,030.00	23,000.00	20.00

[1] Eight river miles north of Iowa-Minnesota border.

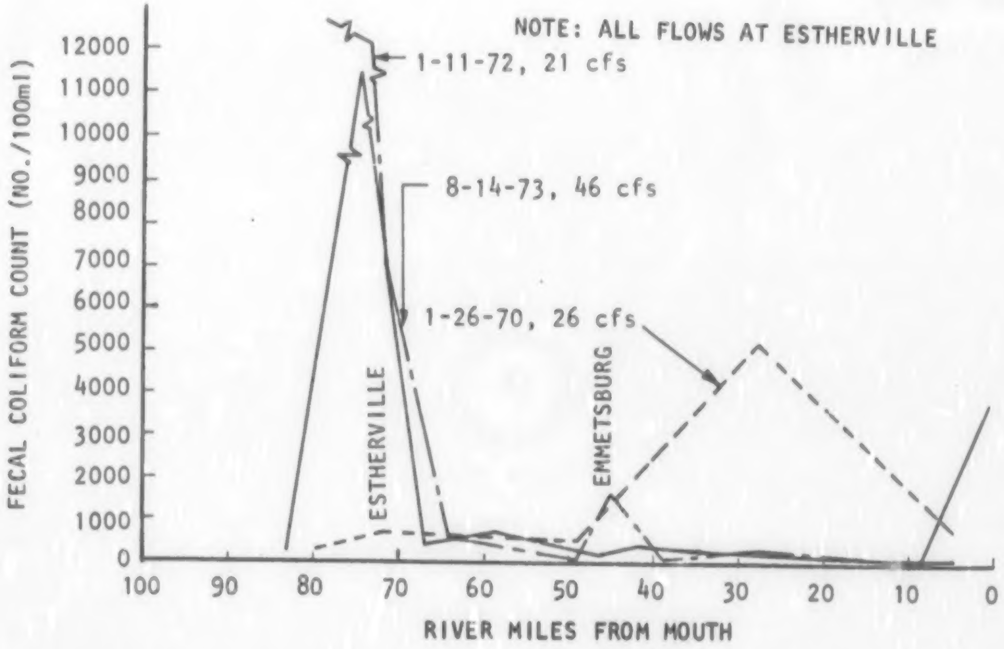


FIGURE IV-27 WEST FORK DES MOINES RIVER, FECAL COLIFORM COUNT

NORTH RACCOON RIVER

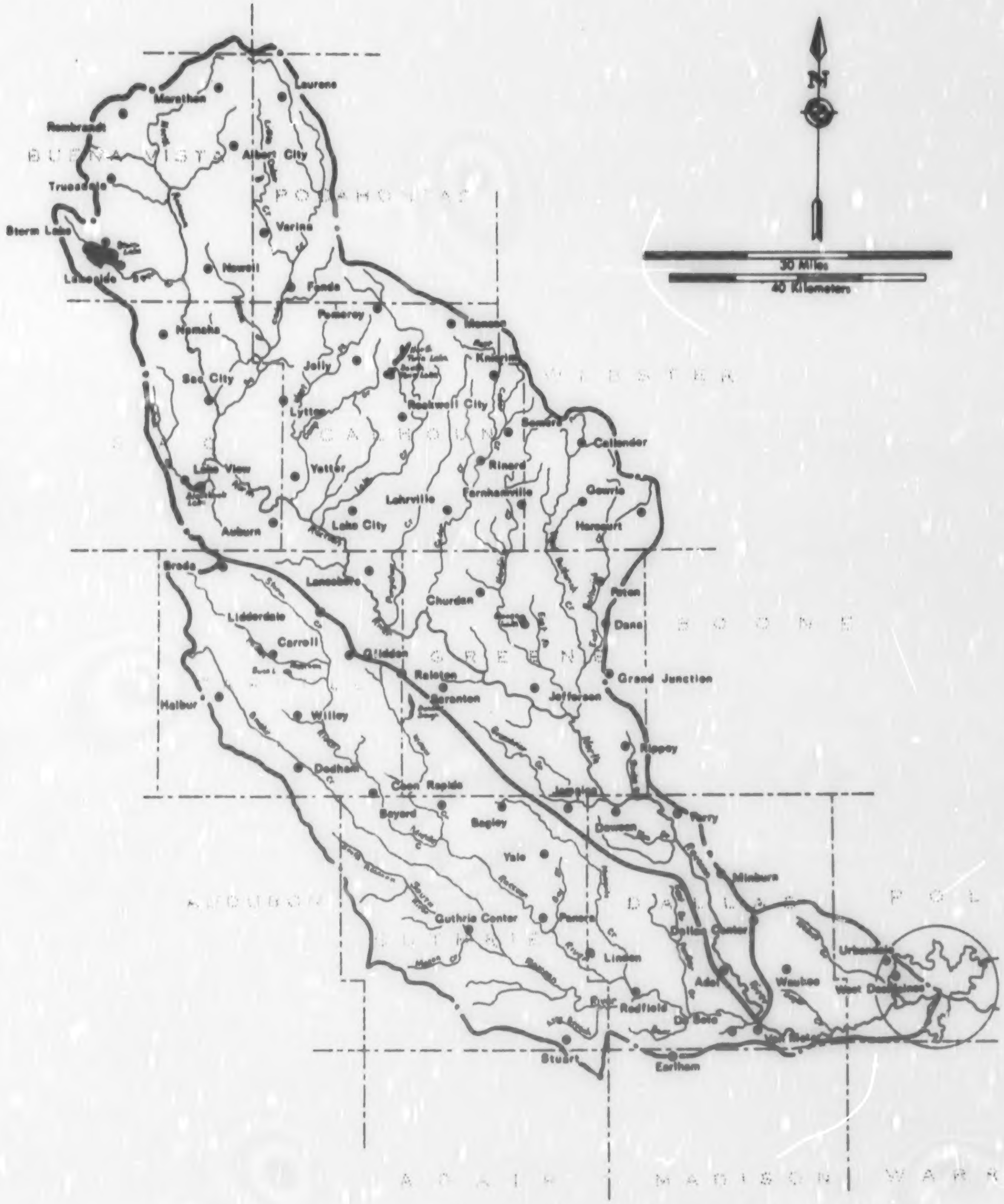
Water quality in the North Raccoon River is by point source discharges with resulting low dissolved oxygen concentrations, high ammonia concentrations, and high fecal coliform concentrations. During winter and low flow conditions numerous violations of Iowa Water Quality Standards occur. Water quality is generally improved during average or above average flow.

Pollution Problems and Sources

Water quality of the North Raccoon River above the first point source, Storm Lake via Boyer Creek, is good. The City of Storm Lake, Hygrade Foods, Sac City, Jefferson, and Perry have a significant impact on stream quality. Normal reaeration at average flow conditions allows recovery below Storm Lake. During low flow or winter periods when reaeration decreases due to low velocity or ice cover the dissolved oxygen concentrations often violate Iowa standards. Ammonia concentrations also exceed Iowa standards over large areas during the winter. The extent to which nonpoint sources contribute nutrients is difficult to determine due to the overwhelming effect of the point sources. Point sources are the greatest problem on the North Raccoon River with respect to dissolved oxygen and ammonia.

Water Quality Conditions

Harmful Substances - No problems associated with harmful substances have been detected in the North Raccoon River.



N
30 Miles
40 Kilometers
BUENA VISTA
POCAHONTAS
WEBSTER
SAC
CALHOUN
CARROLL
GREENE
BOONE
AUDUBON
GUTHRIE
DALLAS
POLK
ADAIR
MADISON
WARREN
Marathon
Laurens
Rembrandt
Albert City
Truesdale
Varina
Storm Lake
Newell
Lakeside
Fonda
Pomeroy
Manson
Nemaha
Jolly
Knierim
Sac City
Lytton
Rockwell City
Somers
Callender
Yetter
Rinard
Lake View
Lohrville
Farnhamville
Gowrie
Auburn
Lake City
Harcourt
Breda
Lanesboro
Churdan
Paton
Lidderdale
Dana
Carroll
Glidden
Ralston
Grand Junction
Scranton
Jefferson
Halbur
Willey
Rippey
Dedham
Coon Rapids
Jamaica
Perry
Bayard
Bagley
Dawson
Minburn
Yale
Guthrie Center
Panora
Dallas Center
Urbandale
Linden
Adel
Waukee
West Des Moines
Redfield
De Soto
Van Meter
Stuart
Earlham

FIGURE IV-28 NORTH RACCOON RIVER BASIN

Water samples for pesticides and metals have been taken more extensively at the Des Moines water supply intake on the main stem of the Raccoon River. Samples on the main stem of the Raccoon River show that lead and copper have exceeded Iowa standards.

Pesticide data for the main stem Raccoon River have generally been in excess of the National Academy of Science recommended maximum levels for DDE, DDT, and dieldrin. DDE concentrations average 48 ng/l in samples with detectable levels and reached a maximum concentration of 250 ng/l. Average concentrations of DDT and dieldrin in samples with detectable levels were 9 ng/l. Maximum concentrations were 23 and 41 ng/l respectively.

TABLE IV-8

HEAVY METALS IN THE NORTH RACCOON RIVER

PARAMETER	TOTAL SAMPLES	NUMBER OF SAMPLES WITH DETECTABLE LEVELS	MEAN OF THOSE WITH DETECTABLE LEVELS (μg/l)	MAXIMUM (μg/l)
As	8	0		
Ba	9	9	170	200
Cd	9	0		
Cr	21	0		
Cu	9	2	20	20
Pb	9	0		
Mn	4	2	140	140
Hg	8	0		
Ni	1	0		
Ag	0	0		
Zn	9	6	23	30

TABLE IV-9

HEAVY METALS IN THE MAIN STEM RACCOON RIVER

PARAMETER	TOTAL SAMPLES	NUMBER OF SAMPLES WITH DETECTABLE LEVELS	MEAN OF THOSE WITH DETECTABLE LEVELS (μg/l)	MAXIMUM (μg/l)
As	0	0		
Ba	15	13	177	300
Cd	16	0		
Cr	16	0		
Cu	16	2	25	40
Pb	16	4	95	290
Mn	1	0		
Hg	2	1	1	1
Ni	15	2	30	40
Ag	1	0		
Zn	15	12	46	140

TABLE IV-10

PESTICIDES IN THE MAIN STEM RACCOON RIVER

PARAMETER	TOTAL SAMPLES	NUMBER OF SAMPLES WITH DETECTABLE LEVELS	MEAN OF THOSE WITH DETECTABLE LEVELS (ug/l)	MAXIMUM (ug/l)
DDE	24	10	48	250
DDT	17	9	9	23
Dieldrin	25	16	8.8	41
Atrazine	9	9	639	3300

Physical Modification - Turbidity, total solids, and temperature on the North Raccoon River are similar to other streams of the State. Limited data are not sufficient to determine the magnitude of nonpoint runoff regarding turbidity and solids. Turbidity concentrations during sampling periods have averaged approximately 30 JTU with a maximum of 110 JTU. Total solids concentrations have averaged approximately 650 mg/l with a maximum of over 1100 mg/l. No temperature problems have been noted on the North Raccoon River.

Oxygen Depletion - Summer dissolved oxygen values ranged from 6.5 mg/l (85% saturation) to 15.5 mg/l (140% saturation), with August having the greatest change between stations. This change is probably the result of diurnal fluctuations rather than significant downstream changes (Figures IV-29 and IV-31). Winter concentrations have varied considerably. Samples collected in February, 1972, and February, 1974, show adequate dissolved oxygen. Winter samples collected in 1971 show numerous violations of Iowa standards. The high dissolved

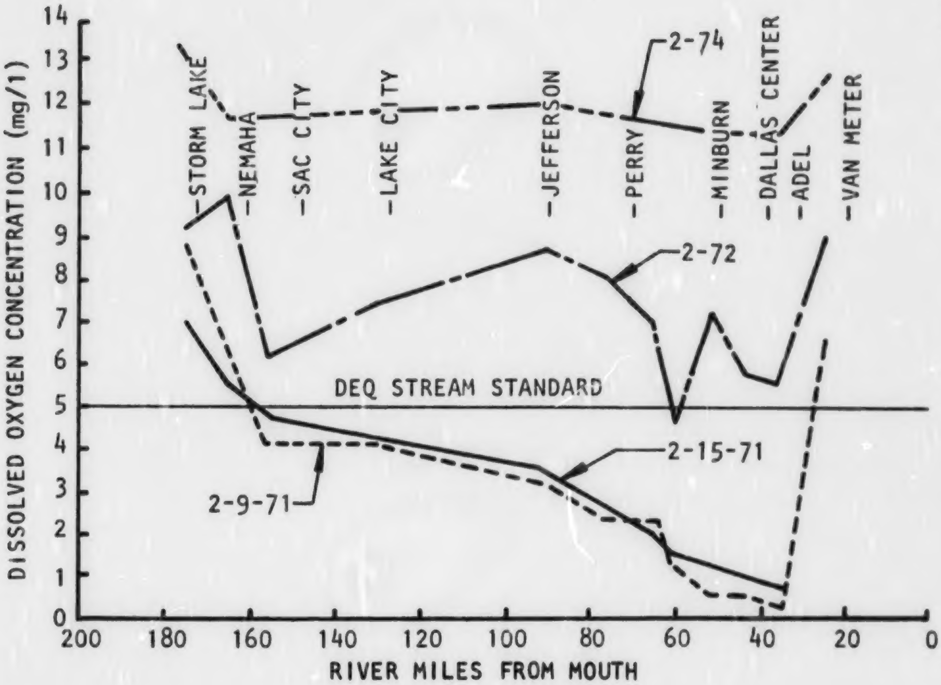


FIGURE IV-29 NORTH RACCOON RIVER, DISSOLVED OXYGEN CONCENTRATIONS

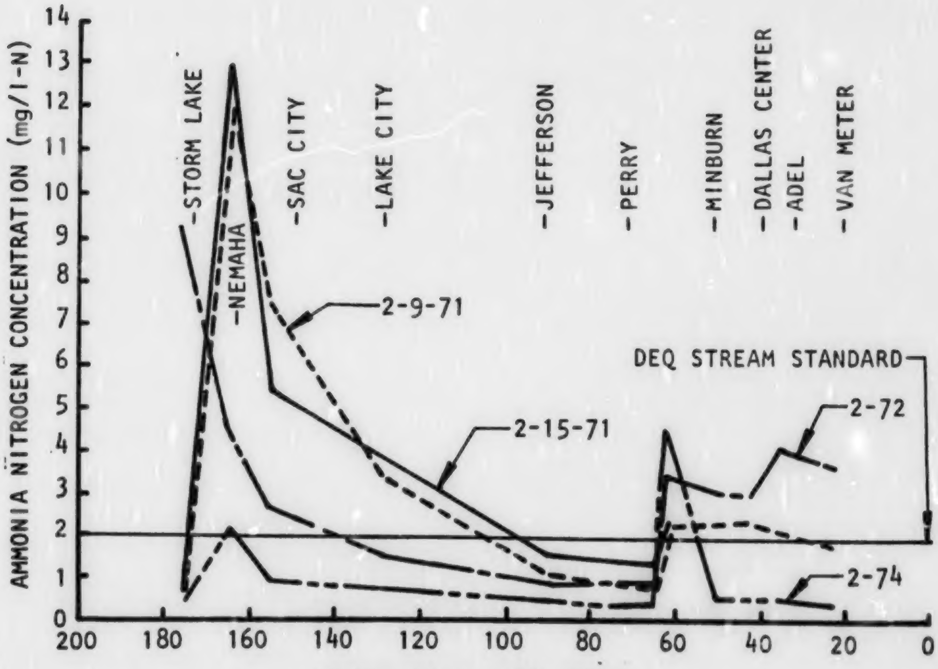


FIGURE IV-30 NORTH RACCOON RIVER, AMMONIA NITROGEN CONCENTRATIONS

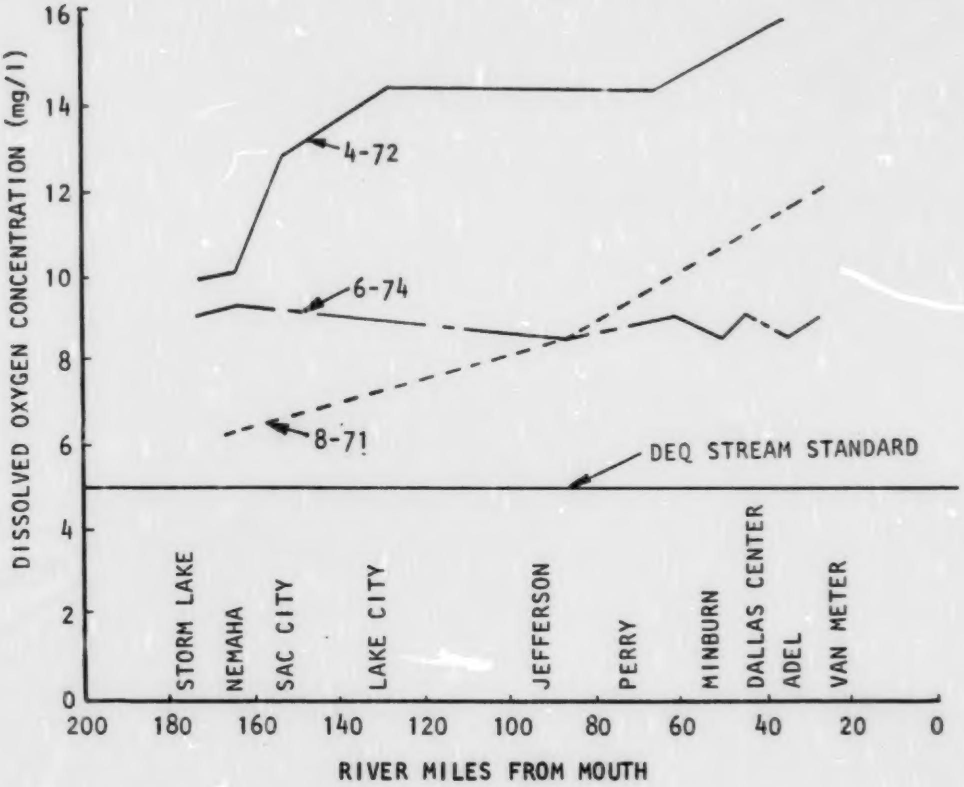


FIGURE IV-31 NORTH RACCOON RIVER, DISSOLVED OXYGEN CONCENTRATIONS

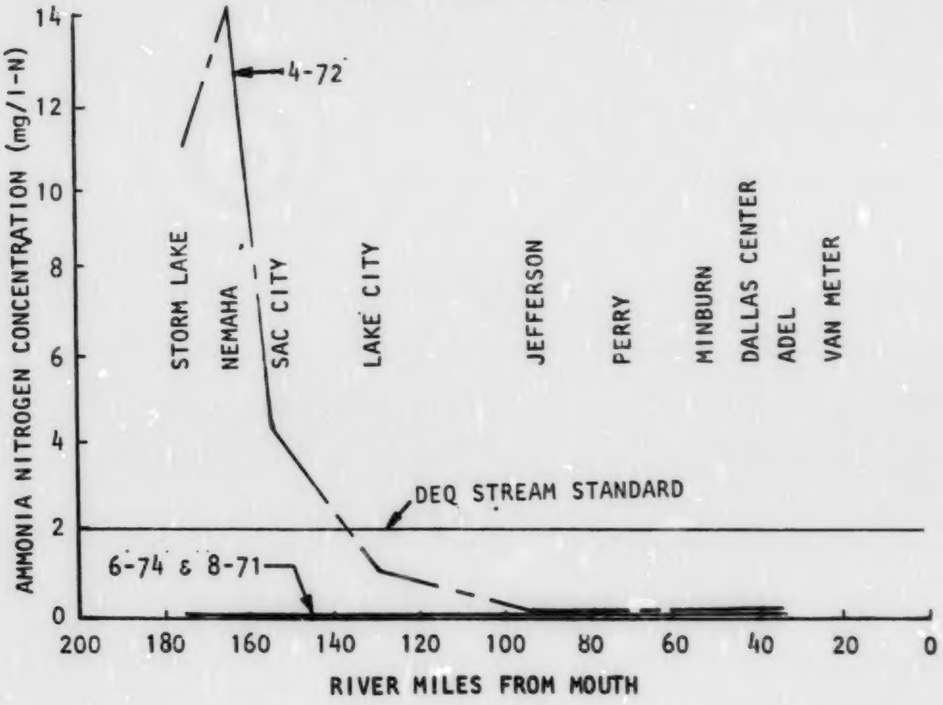


FIGURE IV-32 NORTH RACCOON RIVER, AMMONIA NITROGEN CONCENTRATIONS

oxygen values in 1974 were still only at 80% saturation. Samples collected in January, 1975, while still above Iowa standards, averaged only 50% saturation. Iowa Water Quality Standards have been violated in 8% of the dissolved oxygen and in 17% of the ammonia samples since 1970. Results over the last four years have shown general improvement in water quality in the North Raccoon River. Fewer violations of dissolved oxygen and ammonia standards have been found in the last year even under ice cover and at lower flows than previous surveys. While considerable improvement is still necessary, progress is being made. This is primarily attributable to better operation and/or smaller loading to the stream at Storm Lake. Hygrade Foods has discharged less waste during the last year. While this is unrelated to pollution control measures, it has had a significant impact in stream quality. The discharges at Sac City, Perry, and Oscar Mayer at Perry still have a visible impact. There has not been any demonstrable improvement below these discharges. Due to the lower level of pollutants coming from upstream, the water quality has improved even below the other dischargers. Further improvement will be dependent upon continued lower loadings from Storm Lake and Hygrade Foods, and expanded treatment at Sac City, Perry, Jerrerson, and Oscar Mayer at Perry.

Health Hazards and Aesthetic Degradation - Fecal coliform concentrations show no consistent patter in the North Raccoon River. This would be expected if nonpoint sources were the major pollutant source. Point source effects can be seen but not consistently. Fecal coliform concentrations generally increase below Storm Lake, Sac City and Jefferson. Fecal coliform concentrations are generally higher in the summer than the winter. While there is little significant fluctuation in concentration, the recreation criteria established by the EPA of 200/100 ml is almost always exceeded.

Due to the lack of historical data for coliform bacteria in the North Raccoon River it is difficult to establish any trends over recent years.

TABLE IV-11

BACTERIOLOGICAL DATA - NORTH RACCOON RIVER

SAMPLING	Fecal Coliform per 100 ml				
STATIONS	JUNE '74	JULY '74	AUG '74	FEB '74	JAN '75
Above Storm Lake	660	950	620	50	NS
Boyer Creek	33,000	2,100	4,000	NS	100
Below Storm Lake	1,200	680	560	1,400	160
Nemaha	590	950	690	1,200	10
Below Sac City	2,300	3,700	1,400	450	9,200
Lake City	2,200	NS	14,000	180	70
Above Jefferson	810	550	320	40	10
Below Jefferson	480	4,100	1,400	140	1,200
Above Perry	1,100	520	60	330	180
Below Perry	1,100	490	120	290	440
Adel	680	380	90	160	120
Van Meter	440	240	170	90	950

NS--Not sampled

NORTH, MIDDLE, AND SOUTH RIVERS

The North, Middle, and South Rivers drain over 1,500 square miles of land in south-central Iowa below the Raccoon River basin. The South River basin is the largest of the three draining 590 square miles, followed by the Middle River (558 sq. mi.) and the North River (400 sq. mi.). Approximately the lower half of all three of these rivers has been straightened and channelized. These rivers flow through rolling farm land for the most part, particularly in the North and Middle River basins. The largest cities in the basins are Winterset on the Middle River and Indianola between the Middle and South Rivers. The largest tributaries are Otter Creek and Squaw Creek on the South River, Clanton Creek on the Middle River, and North Branch North River.

Harmful Substances - No pesticide data were available on these rivers. The limited heavy metal data present indicated no problems with heavy metals. Concentrations for metals were near the limits of detection or below. Those metals found include barium, zinc, and lead.

Physical Modification - Turbidity is a problem in these rivers. Samples collected to date have been at high flows and high turbidity has been found. Average turbidities have been near 75 JTU's with maximum concentrations of 150 JTU. No temperature problems have been noted.

Oxygen Depletion - Dissolved oxygen concentrations have been well above Iowa standards in samples collected to date. However, no samples have been collected under critical conditions of low flow or ice cover. Dissolved oxygen under high stream flow runoff conditions has been only near 75% saturation in samples collected in 1975. Samples collected in 1975 showed higher dissolved oxygen concentrations and lower COD concentrations in the North and South Rivers than in the Middle River.

Health Hazards and Aesthetic Degradation - Fecal coliform concentrations in all three rivers exceed Federal guidelines of 200/100 ml, particularly during high stream flows. However, fecal coliform appear to be significantly higher in the Middle River than in the North or South rivers.

Summary - In terms of fecal coliform, dissolved oxygen, and COD, samples collected in 1975 indicate poorer water quality in the Middle River than in the North or South rivers, with best water quality in the North River. All of these rivers have greatly improved water quality upstream of the channelized reaches. This is due not only to the lack of channelization but the smaller drainage area.

OTHER TRIBUTARIES

Available water quality data on other tributaries in the Des Moines Basin is sparse. Infrequent and random samplings combined with only minimal analyses make any significant evaluation of water quality on other streams in the Des Moines Basin impossible.

REFERENCES

Information and data for this chapter were obtained from the federal water quality data storage system (STORET), the DEQ files, and the following sources:

An Inventory of Water Resources and Water Problems, Des Moines River Basin, Iowa, prepared by the Iowa Natural Resources Council, 1953.

Des Moines River (Fort Dodge to Des Moines), Limnology Study June-August 1973, State Hygienic Laboratory Report #74-19, University of Iowa, Iowa City, Iowa. January 16, 1974. 29 p.

Water Quality Survey of the Des Moines River, Des Moines, Iowa area. State Hygienic Laboratory Report #71-13. University of Iowa, Iowa City, Iowa. October 1, 1970. 28 p.

Des Moines River (Des Moines to Keokuk), Limnology Study July 1973-January 1974. State Hygienic Laboratory Report #74-35. University of Iowa, Iowa City, Iowa. April 25, 1974. 30 p.

Upper Des Moines (East & West Forks), Limnology Study June-August, 1973. State Hygienic Laboratory Report #74-11. University of Iowa, Iowa City, Iowa. 56 p.

Winter Water Quality of the North Raccoon River from Storm Lake to Van Meter, Iowa. State Hygienic Laboratory Report #71-41. University of Iowa, Iowa City, Iowa. March 26, 1971. 24 p.

Des Moines River (East and West Forks to Des Moines, Iowa) Winter Water Quality Study. State Hygienic Laboratory Report #75-1. University of Iowa, Iowa City, Iowa. July 25, 1974. 20 p.

West Fork Des Moines River Water Quality Survey, Estherville, Iowa Area. State Hygienic Laboratory Report #72-38. University of Iowa, Iowa City, Iowa. February 24, 1972. 25 p.

Investigation of the North Raccoon River Fish Kill Below Storm Lake, Iowa, April 9-11, 1972. State Hygienic Laboratory Report #72-53. University of Iowa, Iowa City, Iowa. April 27, 1972. 16 p.

Winter Water Quality of the North Raccoon River from Storm Lake to Van Meter, Iowa. State Hygienic Laboratory Report #72-49. University of Iowa, Iowa City, Iowa. April 27, 1972. 17 p.

North Raccoon River Limnology Study Report #75-21. State Hygienic Laboratory, University of Iowa, Iowa City, Iowa. March 24, 1975.

CHAPTER V - POINT SOURCE DISCHARGE INVENTORY

Municipal, industrial, and semipublic point sources of wastewater, as identified in the DEQ files as discharging to surface waters in the Des Moines River Basin, have been inventoried and tabulated. Agricultural and some nonpoint sources are inventoried in Chapter VII.

An alphabetical listing of municipal, industrial, and semipublic wastewater discharges appears in Table V-1. Also included in this table is information concerning the location of each discharge (by county and river mile), and an identification of the receiving stream for each discharge.

A coding system was used in Table V-1, which assigned a reference number to each discharge. Reference numbers for municipal sources are prefixed by "M", industrial sources by "I", and semipublic sources by "S", (all incorporated municipalities have been assigned reference numbers whether they have discharges or not). The reference numbers are used to identify specific existing discharges in Figures V-1, V-2 and V-3, which show the location of point source discharges in the Upper Des Moines, Raccoon, and Lower Des Moines subbasins, respectively. With few exceptions, reference numbers run in a consecutive downstream order beginning at the northern end of the basin.

Table V-1 also cross references information concerning the present characteristics of each discharge, the waste load allocation for each discharge, and an estimate of the municipal cost involved in meeting the allocation.

Table V-2 identifies characteristics of each wastewater point discharge from municipal, semi-public, and industrial sources. Beginning with the upstream end of the Blue Earth River, dischargers are listed in order proceeding downstream to the Iowa-Minnesota State border. The tabulation then continues with the upstream end of the West Fork Des Moines River and lists dischargers in downstream order. For each tributary stream the point source furthest upstream is identified and the tabulation continues downstream to the main channel.

Table V-2 lists present design capacity, present average daily flow, BOD_5 and ammonia nitrogen effluent concentrations, type of treatment processes, method of sludge disposal, and comments, for each discharger. Treatment processes are identified only in general terms. Specific process descriptions can be obtained from the DEQ. The comments section may include information obtained by the DEQ personnel concerning existing operation, age of existing facilities, specific DEQ operation permit requirements, DEQ orders for additional treatment, or a delineation of proposed facilities.

A total of 133 municipal treatment facilities and three sanitary districts have been identified in the basin. In addition, 86 small communities presently without municipal collection or treatment systems are included in Tables V-1 and V-2.

MUNICIPAL

Municipal sewage flow and operational data for municipalities were extracted from the DEQ records. Average flow values contained in reports submitted by treatment plant operators have been used. Flow values shown in Table V-2 are the averages obtained for the last full year of record; in most instances 1973.

Most effluent quality data were collected from the DEQ's Effluent Quality Analysis Program (EQAP). These data were supplemented by wastewater treatment facility operation reports. Data reported through EQAP are the results of tests conducted by the Iowa State Hygienic Laboratory on wastewater samples supplied by the individual dischargers. In most instances, no more than four BOD_5 values and two ammonia nitrogen values are reported each year. This is due to the fact that a significant portion of the facilities are lagoons that only discharge a few times each year. No samples are required when the facilities are not discharging.

The results of BOD_5 analyses performed by the Iowa State Hygienic Laboratory (reported in EQAP) are reported as being between 25 mg/l and 150 mg/l. For some communities a percentage of the values reported are 25 or "25-" mg/l. Values designated "25-" are less than 25 mg/l, but were assumed to be equal to 25 mg/l for this study. Thus, the actual average effluent BOD_5 concentration may in some cases be lower than that obtained from EQAP information. The adequacy of the program will be reviewed since some dischargers are, or soon will be, required to provide BOD_5 removals to less than 25 mg/l. In some instances, due to a sparsity and scattering of data, engineering judgement was applied to arrive at representative values rather than taking strict averages of the available data.

SEMIPUBLIC

Information identifying semipublic treatment facilities in the study area was obtained from the DEQ files. Description of wastewater discharges from semipublic facilities was difficult due to the minimal surveillance provided. Quantitative and qualitative data were obtained from EQAP reports or design information from the DEQ files. Values in Table V-2 are based on both limited operational data and design characteristics, and may not accurately reflect present operating conditions.

INDUSTRIAL

Information on industries discharging wastewater to streams within the study area was obtained from the U.S. Army Corps of Engineers discharge permit applications (Discharge Permit Program, River and Harbors Act of 1899), the DEQ industrial files, and the National Pollutant Discharge Elimination System (NPDES) permit applications. Although these sources provide the best available discharge information, caution must be exercised in its interpretation since it represents data that has been submitted by the individual industries with very little verification.

SUMMARY

The distribution of hydraulic and organic loads upon the streams in the Des Moines River Basin from municipal, industrial, and semipublic point sources, is summarized in Table V-3. The relatively small quantity of BOD_5 and ammonia-N discharged by industries and semipublic facilities compared to their flow is due to the following:

1. Several quarries discharge large volumes of water, but add very little BOD_5 to the stream.
2. Several industrial discharges consist only of cooling water; which adds negligible amounts of BOD_5 to the stream.
3. Insufficient monitoring data exist for many of the semipublic and industrial facilities to detect actual quantities.

Table V-4 summarizes the various types of municipal wastewater treatment facilities, the number of facilities, and the population served, for each subbasin. Table V-5 is a summary of treatment types for the entire Des Moines River Basin.

None of the communities in the study area presently operate advanced waste treatment facilities, however, plans have been approved for three advanced waste treatment facilities. The City of Emmetsburg has under construction a rotating biological disk facility designed to reduce BOD_5 to 10 mg/l and ammonia-N to 2 mg/l. The City of Estherville has approved plans for polishing ponds and dual-media filters following secondary activated sludge treatment. The City of Fort Dodge has under construction a two stage trickling filter plant designed to reduce BOD_5 to 21 mg/l and ammonia-N to 3 mg/l. In addition, this plant will subsequently be modified to meet a more stringent waste load allocation.

TABLE V-1
POINT SOURCE
WASTEWATER DISCHARGES

Discharger1/	Reference Number	County	River Mile2/	Discharge To3/	Page Reference	
					Inventory	Needs
MUNICIPAL					Chapter V	Chapter VIII
Ackworth	M-181	Warren	--	NEMTF	57	33
Adair	M-164	Adair	111/180	S. Fork Middle River	53	27
Adel	M-124	Dallas	--/199	N. Raccoon River	45	13
Albert City	M- 82	Buena Vista	184/199	Lateral 2	38	24
Albia SW	M-205	Monroe	--/114	Middle Creek	63	11
Albia N	M-206	Monroe	--/114	Miller Creek	63	11
Algona	M- 30	Kossuth	42/329	E. Fork D.M. River	27	29
Alleman	M-227	Polk	--/191	Four Mile Creek	51	18
Altoona	M-155	Polk	--/191	Four Mile Creek	51	17
Ankeny E	M-153	Polk	--/191	Four Mile Creek	51	17
Ankeny W	M-154-1	Polk	--/205	Saylor Creek	38	11
Ankeny Ind.	M-154-2	Polk	--/210	Rock Creek D.M. River	36	10
Arcadia	M-126	Carroll	--	NEMTF	45	31
Armstrong	M- 22	Emmet	90/329	E. Fork D.M. River	25	29
Auburn	M- 94	Sac	--	NEMTF	41	24
Ayrshire	M- 10	Palo Alto	--	NEMTF	24	22
Badger	M- 38	Webster	--/326	Badger Cr. to D.M. River	28	22
Bagley	M-140	Guthrie	--/199	Mosquito Creek	47	11
Bancroft	M- 24	Kossuth	64/329	Mud Cr. to E. Fork D.M. River	26	11
Barnum	M-43	Webster	--	NEMTF	29	23
Bayard	M-137	Guthrie	--	NEMTF	47	28
Beacon	M-202	Mahaska	--/115	Muchakinock Creek	63	19
Beaver	M- 72	Boone	--	NEMTF	37	
Berkley	M- 74	Boone	--	NEMTF	37	
Bevington	M-166	Madison	--	NEMTF	54	
Blakesburg	M-213	Wapello	--	NEMTF	65	26
Bode	M- 33	Humboldt	--/348	Trulner Creek	28	21
Bonaparte	M-217	Van Buren	--	NEMTF	66	25
Bondurant	M-175	Polk	--/177	Mud Cr. To D.M. River	55	13
Boone	M- 68	Boone	--/251	Honey Cr. to D.M. River	35	12
Bouton	M- 76	Dallas	--	NEMTF	37	31
Boxholm	M- 66	Boone	--	NEMTF	35	18
Bradgate	M- 18	Humboldt	--	NEMTF	25	
Breda	M-130	Carroll	122/199	Middle Raccoon	46	16
Britt	M- 52	Hancock	--/282	Middle Branch Boone River	32	14
Buffalo Center	M- 3	Winnebago	--	DD7 to Blue Earth River	22	33
Burt	M- 25	Kossuth	61/329	E. Fork D.M. River	26	19
Bussey	M-200	Marion	--/127	S. Coal Cr. to N. Coal Cr.	61	20
Callendar	M-112	Webster	79/199	W. Butterick Creek	43	26
Carlisle	M-163	Warren	15/186	N. River	29	32
Carroll	M-131	Carroll	112/199	Middle Raccoon	46	19
Casey	M-165	Guthrie	111/180	Middle River	54	28
Chillicothe	M-209	Wapello	--	NEMTF	63	20
Churdan	M-111	Greene	80/199	Hardin Creek	43	26
Clare	M- 42	Webster	--	NEMTF	29	23
Clarion	M- 60	Wright	89/199	DD2 to Eagle Creek	33	11
Clive	M-147	Polk	--	Des Moines STP	50	
Coon Rapids	M-134	Carroll	94/199	Middle Raccoon River	46	27
Corwith	M- 51	Hancock	89/282	Boone River	32	16
Cumming	M-162	Warren	48/186	NEMTF	52	32

TABLE V-1
POINT SOURCE
WASTEWATER DISCHARGES

					Page Reference	
Discharger[1]	Reference Number	County	River Mile[2]	Discharge To[3]	Inventory Chapter V	Needs Chapter VIII
Curlew	M- 14	Hancock	--	NEMTF	25	
Cylinder	M- 11	Palo Alto	--	NEMTF	25	22
Dakota City	M- 36	Humboldt	5/329	E. Fork D.M. River	29	26
Dallas	M-194	Marion	--/140	Tracy Cr. to English Cr.	61	20
Dallas Center	M-123	Dallas	6/199	Walnut Creek	50	22
Dana	M-116	Greene	--	NEMTF	45	
Dawson	M-120	Dallas	--	NEMTF	45	27
Dayton	M- 64	Webster	--/276	Skillet Cr. to D.M. River	35	15
Dedham	M-128	Carroll	69/199	Brushy Creek	46	31
Des Moines	M-150	Polk	196	Des Moines River	52	10
Des Moines H H	M-151	Polk	--/186	North River	53	15
Des Moines-C	M-222	Polk	--/194	Yeader Cr. to D.M. River	52	17
Des Moines-B	M-223	Polk	--/186	North River	54	31
DeSoto	M-144	Dallas	30/199	Bugler Creek	49	24
Dexter	M-158	Dallas	--/186	N. Branch to N. River	53	29
Dolliver	M- 21	Boone	--	NEMTF	26	
Donnellson	M-219	Lee	--/ 6	Sugar Creek	68	13
Duncombe	M- 50	Webster	69/199	Brushy Creek	32	23
Eagle Grove	M- 59	Wright	47/282	DD 94 to Boone River	34	10
Earlham	M-143	Madison	38/199	Bear Creek/S. Raccoon	48	19
East Peru	M-170	Madison	--	NEMTF	56	
Eddyville	M-207	Wapello	113	Des Moines River	64	12
Eldon	M-211	Wapello	80	Des Moines River	65	25
Emmetsburg	M- 9	Palo Alto	48/329	W. Fork D.M. River	25	11
Estherville	M- 5	Emmet	79/329	W. Fork D.M. River	24	10
Farmington	M-218	Van Buren	--	NEMTF	67	25
Farnhamville	M-110	Calhoun	80/199	Hardin Creek	44	15
Fenton	M- 28	Kossuth	--	NEMTF	27	30
Floris	M-214	Davis	78	NEMTF	66	
Fonda	M- 91	Pocahontas	105/199	Cedar Creek	41	13
Fort Dodge	M- 45	Webster	314	Des Moines River	31	12
Fraser	M- 65	Boone	--	NEMTF	35	
Gilmore City	M- 41	Humboldt	--/313	N. Branch Lizard Creek	30	21
Glidden	M-135	Carroll	63/199	Willow Creek	48	15
Goldfield	M- 57	Wright	61/282	Boone River	34	12
Gowrie	M-113	Webster	79/199	W. Butterick Creek	45	15
Graettinger	M- 8	Palo Alto	64/329	W. Fork D.M. River	24	15
Grand Junction	M-117	Greene	--/206	W. Beaver Creek	36	31
Granger	M- 77	Dallas	--/206	Beaver Creek	38	29
Greenfield Plaza	S-161	Warren	18/186	North River	54	32
Grimes	M- 78	Polk	--/206	Beaver Creek	38	29
Gruver	M- 6	Emmet	--	NEMTF	24	22
Guthrie Center	M-125	Guthrie	73/199	S. Raccoon River	46	30
Halbur	M-127	Carroll	--	NEMTF	46	31
Hamilton	M-199	Marion	--	NEMTF	62	20
Harcourt	M-114	Webster	--	NEMTF	45	27
Hardy	M- 35	Humboldt	--	NEMTF	29	
Hartford	M-228	Warren	--	NEMTF	56	28
Harvey	M-195	Marion	--	NEMTF	61	20
Havelock	M- 39	Pocahontas	--	NEMTF	30	23

TABLE V-1
POINT SOURCE
WASTEWATER DISCHARGES

Discharger[1]	Reference Number	County	River Mile[2]	Discharge To[3]	Page Reference	
					Inventory Chapter V	Needs Chapter VIII
Humboldt	M- 20	Humboldt	4/329	W. Fork D.M. River	26	21
Indianola N	M-174	Warren	16/180	Middle River	56	19
Indianola S	M-179	Warren	--/176	South River	57	32
IA Met. Sewer	S-160	Warren	12/186	North River	54	
Jamaica	M-118	Guthrie	--	NEMTF	45	27
Jefferson	M-109	Greene	89/199	DD 132	44	14
Johnston	M-224	Polk	--	NEMTF	38	29
Jolley	M- 95	Calhoun	--	NEMTF	42	
Kanawha	M- 56	Hancock	--/282	W. Otter Creek	33	14
Keosauqua	M-216	Van Buren	51	Des Moines River	67	25
Kirkville	M-208	Wapello	--	NEMTF	64	20
Knierim	M-104	Calhoun	--	NEMTF	43	
Knoxville	M-191	Marion	--/149	Competine Cr. To White Breast Cr.	60	17
Lacona	M-190	Warren	--/149	Mill Branch to White Breast Cr.	60	33
Lake City N	M-100	Calhoun	130/199	Lake Creek	43	20
Lake City SW	M-101	Calhoun	130/199	Lime Creek	43	16
Lakeside	M- 86	Buena Vista	--	NEMTF	40	25
Lake View	M- 93	Sac	149/199	Indian Creek	42	14
Lakota	M- 2	Kossuth	--	NEMTF	23	33
Lanesboro	M-102	Carroll	--	NEMTF	43	24
Laurens	M- 89	Pocahontas	105/199	Cedar Creek	41	12
Ledyard	M- 1	Kossuth	--	NEMTF	23	33
Lehigh	M- 48	Webster	295	Crooked Cr. to D.M. River	32	23
Leighton	M-201	Mahaska	--	NEMTF	63	
Libertyville	M-215	Jefferson	--	NEMTF	67	26
Lidderdale	M-132	Carroll	108/199	Storm Creek	47	28
Linden	M-139	Dallas	--	NEMTF	48	28
Livermore	M- 31	Humboldt	20/329	E. Fork D.M. River	28	30
Lohrville	M-107	Calhoun	105/199	Cedar Creek	43	26
Lone Rock	M- 29	Kossuth	--	NEMTF	28	
Lovilia	M-198	Monroe	--/127	S. Coal Cr. to N. Coal Cr.	62	20
Lucas	M-188	Lucas	--	NEMTF	60	33
Luther	M- 69	Boone	--	NEMTF	36	18
Luverne	M- 54	Kossuth	--	NEMTF	33	21
Lytton	M- 96	Sac	135/199	Camp Creek	42	19
Madrid	M- 70	Boone	--/214	Little Creek	37	18
Mallard	M- 15	Palo Alto	--	NEMTF	25	21
Manson	M-103	Calhoun	105/199	Cedar Creek	43	24
Marathon	M- 80	Buena Vista	--	NEMTF	39	25
Martensdale	M-169	Warren	24/180	Middle River	55	27
Marysville	M-197	Marion	--	NEMTF	62	
Melcher	M-193	Marion	--/140	Tracy Cr. to English Cr.	61	16
Melrose	M-196	Monroe	--	NEMTF	62	
Menlo	M-157	Guthrie	--	NEMTF	53	32
Milo	M-180	Warren	--/176	Otter Cr. to South River	58	32
Minburn	M-122	Dallas	52/199	N. Raccoon River	46	26
Mitchellville	M-184	Polk	--/174	Camp Creek	58	17
Monroe	M-225	Jasper	--/154	Brush Creek to D.M. River	59	17
Moorland	M- 44	Webster	--	NEMTF	31	23
Moravia	M-212	Appanoose	--/ 78	S. Soap to Soap Creek	66	25

TABLE V-1
POINT SOURCE
WASTEWATER DISCHARGES

					Page Reference	
Discharger[1/]	Reference Number	County	River Mile[2/]	Discharge To[3/]	Inventory	Needs
					Chapter V	Chapter VIII
Nemaha	M- 88	Sac	--	NEMTF	41	
Newell	M- 92	Buena Vista	154/199	N. Raccoon River	42	30
New Virginia	M-178	Warren	--/176	Squaw Cr. to South River	57	32
Norwalk	M-159	Warren	12/186	Iowa Metro Sewer	53	32
Ogden	M- 73	Boone	--/206	Beaver Creek	38	14
Osceola	M-186-1	Clarke	--/149	White Breast Creek	59	22
Osceola	M-186-2	Clarke	--/149	White Breast Creek	59	29
Oskaloosa	M-203	Mahaska	--/115	Little Muchakinock Creek	63	19
Oskaloosa	M-204	Mahaska	--/115	Little Muchakinock Creek	63	19
Otho	M- 47	Webster	305	Dry Run to D.M. River	32	23
Ottosen	M- 34	Humboldt	--	NEMTF	29	
Ottumwa	M-210	Wapello	97	Des Moines River	65	25
Palmer	M-225	Pocahontas	--	NEMTF	30	23
Panora	M-138	Guthrie	62/199	Middle Raccoon River	48	12
Paton	M-115	Greene	--	NEMTF	45	27
Patterson	M-167	Madison	--	NEMTF	55	28
Pella	M-192	Marion	--/140	Sents Creek	61	14
Perry	M-121	Dallas	61/199	North Raccoon River	45	15
Pilot Mound	M- 67	Boone	--	NEMTF	36	18
Pioneer	M- 37	Humboldt	--	NEMTF	29	
Pleasant Hill	M-156	Polk	191	Des Moines River	53	17
Plesantville	M-183	Marion	--/157	Coal Cr. to South River	58	32
Plover	M- 16	Pocahontas	--	NEMTF	25	
Pocahontas	M- 40	Pocahontas	34/313	Lizard Creek	30	16
Polk City	M- 71	Polk	--/214	Big Creek	37	13
Pomeroy	M- 98	Calhoun	130/199	Lake Creek	43	23
Prairie City	M-185	Jasper	--/157	Calhoun Creek	59	11
Rake	M- 4	Winnebago	--	NEMTF	23	33
Ralston	M-136	Carroll	--	NEMTF	48	
Redfield	M-142	Dallas	46/199	Middle Raccoon River	49	30
Rembrandt	M- 81	Buena Vista	196/199	N. Raccoon River	39	25
Renwick	M- 55	Humboldt	67/282	DD 3,47 to Boone River	33	21
Ringsted	M- 27	Emmet	49/329	Black Cat Creek	27	30
Rinard	M-106	Calhoun	105/199	Cedar Creek	43	24
Rippey	M-119	Greene	66/199	Snake Creek	45	26
Rockwell City	M- 99	Calhoun	130/199	Lake Creek	43	13
Rodman	M- 12	Palo Alto	--	NEMTF	25	
Rolfe	M- 17	Pocahontas	18/329	Pilot Cr. to W.F. D.M. River	25	15
Runnells	M-176	Polk	--	NEMTF	57	18
Rutland	M- 19	Humboldt	--	NEMTF	26	22
Sac City	M- 87	Sac	156/199	North Raccoon River	41	12
St. Charles	M-172	Madison	--	NEMTF	56	28
St. Marys	M-177	Warren	--	NEMTF	57	
Sandyville	M-182	Warren	--	NEMTF	58	
Savage S.D.	M- 46	Webster	310	Des Moines River	32	23
Scranton	M-108	Greene	93/199	DD 171	44	16
Sheldahl	M-221	Polk	--/214	Big Creek	36	18
Slater	M-152	Story	--/191	Four Mile Creek	52	14
Somers	M-105	Calhoun	--	NEMTF	43	24
Spring Hill	M-173	Warren	--	NEMTF	56	28
Storm Lake	M- 84	Buena Vista	174/199	Boyer Creek	40	11
Storm Lake Hy-grade	M- 85	Buena Vista	174/199	Boyer Creek	40	
Stratford	M- 63	Webster	283	Dry Run to D.M. River	35	18
Stuart	M-129	Adair	51/199	Long Branch Creek	46	30
Swea City	M- 23	Kossuth	64/329	Mud Creek	26	30

TABLE V-1
POINT SOURCE
WASTEWATER DISCHARGES

Discharger[1/]	Reference Number	County	River Mile[2/]	Discharge To[3/]	Page Reference Inventory Chapter V	Needs Chapter VIII
Thor	M-58	Humboldt	--	NEMTF	34	21
Titonka	M- 26	Kossuth	58/329	Buffalo Creek	27	19
Truro	M-171	Madison	--/180	Hay Br. Clanton Cr. to	56	27
Truesdale	M- 83	Buena Vista	--	NEMTF	40	
Urbandale S.D.	M- 79	Polk	--/206	Beaver Creek	38	29
Van Meter	M-145	Dallas	29/199	Raccoon River	49	22
Varina	M- 90	Pocahontas	--	NEMTF	41	
Vincent	M- 49	Webster	--/286	Brushy Creek	32	24
Wallingford	M- 7	Emmet	--	NEMTF	24	22
Waukee	M-146	Dallas	18/199	Sugar Creek	50	22
Webster City	M- 62	Hamilton	24/282	Boone River	35	12
Wesley	M- 53	Kossuth	--	NEMTF	33	21
West Bend	M- 13	Kossuth	51/329	Prairie Cr. to W. Fork D.M. River	25	16
West Des Moines	M-148	Polk	--	To Des Moines STP	51	
Whittemore	M- 32	Kossuth	20/329	Lotts Creek	28	11
Willey	M-133	Carroll	--	NEMTF	47	
Williamson	M-189	Lucas	--	NEMTF	60	33
Windsor Heights	M-149	Polk	--	To Des Moines STP	51	
Winterset	M-166	Madison	55/180	Middle River	55	14
Woodburn	M-187	Clarke	--	NEMTF	60	33
Woodward	M- 75	Dallas	--/206	Beaver Creek	38	31
Woolstock	M- 61	Wright	--	NEMTF	34	21
Yale	M-141	Guthrie	--	NEMTF	48	28
Yetter	M- 97	Calhoun	--	NEMTF	42	
Semipublic						
Adel WTP	S- 51	Dallas	--/199	North Raccoon River	45	
Algona WTP	S- 10	Kossuth	42/329	E. Fork D.M. River	27	
Argyle School	S-104	Lee	10/ 6	Main Creek	67	
Assembly of God	S- 25	Boone	233	Des Moines River	35	
Bancroft WTP	S- 6	Kossuth	64/329	Mud Cr. to E. Fork D.M. River	26	
Boone County Home	S- 22	Boone	--/265	Poor Farm Cr. to D.M. River	34	
Boone WTP	S- 24	Boone	--/251	Honey Cr. to D.M. River	35	
Britt WTP	S- 18	Hancock	--/282	East Br. Boone River	32	
Burr Oak Manor	S- 11	Kossuth	41/329	East Fork D.M. River	27	
Carlisle WTP	S- 77	Warren	1/186	North River	53	
Camp Dodge	S- 33	Polk	--/206	Beaver Creek	36	
Camp Laurie	S- 21	Boone	242	Des Moines River	35	
Central HS	S-105	Lee	10/ 6	Main Creek	67	
Country Air MHP	S- 26	Boone	235	Des Moines River	35	
Country Living MHPS	S- 72	Polk	--/191	Four Mile Creek	52	

TABLE V-1
POINT SOURCE
WASTEWATER DISCHARGES

Discharger[1]	Reference Number	County	River Mile[2]	Discharge To[3]	Page Reference Inventory	Needs
					Chapter V	VIII
Country Village	S- 37	Buena Vista	174/199	Boyer Creek	38	
Crossroads Enterp.	S- 45	Buena Vista	93/199	DD 171	42	
Dallas Center WTP	S-50	Dallas	--/199	N. Raccoon River	48	
Dallas County Home	S-111	Dallas	--/199	N. Raccoon River	44	
Des Moines Golf & Country Club	S- 64	Dallas	6/199	Walnut Creek	48	
D.M. Waterworks	S- 68	Dallas	--/199	Raccoon River	49	
Diamondhead Lake	S- 52	Dallas	51/199	Long Branch to S. Raccoon R.	45	
Eagle Grove WTP	S- 19	Wright	--/282	DD 94 to Boone River	32	
Eldon WTP	S- 99	Wapello	--/ 80	Chippewa Creek	63	
Elk Rock State Park	S-108	Marion	--/155	Des Moines River	57	
Emmetsburg WTP	S- 2	Palo Alto	48/329	W. Fork D.M. River	23	
Episcopal Center & Conf. Camp	S- 23	Boone	--/265	Poor Farm Cr. to D.M. River	33	
Estherville WTP	S- 1	Emmet	79/329	W. Fork Des Moines River	23	
Farmhamville WTP	S- 47	Calhoun	80/199	Hardin Cr. to N. Raccoon River	42	
First Continental Co. Motel	S- 34	Polk	--/206	Beaver Creek	36	
Fonda WTP	S- 40	Pocahontas	105/199	Cedar Cr. to N. Raccoon River	39	
For Dodge Mun. Airport	S- 14	Webster	315	Des Moines River	29	
Fort Dodge WTP	S- 15	Webster	316	Des Moines River	29	
Fox Creek Water Co.	S- 61	Polk	18/199	Sugar Creek	48	
Giles High Rise Motel	S- 62	Dallas	8/199	Jordan Creek	48	
Glidden WTP	S- 55	Carroll	108/199	Storm Cr. to Middle Raccoon Riv.	46	
Gowrie WTP	S- 48	Webster	78/199	Butterick Cr. to N. Raccoon Riv.	42	
Greenwood WTP	S- 70	Polk	--/191	Four Mile Creek	50	
Hackerts MHP	S- 95	Mahaska	--/115	Little Muchakinock Cr.	61	
Harmony Comm. H.S.	S-102	Van Buren	30	Des Moines River	65	
Hartford MHP	S- 80	Warren	--/180	Middle River	55	
Hinkson MHP	S- 63	Dallas	6/199	Walnut Creek	49	
Humboldt WTP	S- 5	Humboldt	4/329	W. Fork D.M. River	25	
IA DOT						
I-80S.S. #001R	S- 78-A	Adair	--/180	Middle River	54	
I-80N.S. #002R	S- 78-B	Adair	--/180	Middle River	54	
I-80S.S. #011R & N.S. #012R	S- 84	Polk	--/174	Camp Creek	57	
I-35W.S. #017R & E.S. #018R	S-107	Polk	--/191	Four Mile Creek	51	
I-80S.S. #021R & N.S. #022R	S- 59	Dallas	--/199	Raccoon River	48	
I-35W.S. #031R & E.S. #032R	S- 86	Clarke	--/149	White Breast Creek	58	
IA Promotional Management	S- 82	Clarke	--/176	Squaw Cr. to S. River	56	

TABLE V-1
POINT SOURCE
WASTEWATER DISCHARGES

Discharger[1]	Reference Number	County	River Mile[2]	Discharge To[3]	Page Reference Inventory Chapter V	Page Reference Needs VIII
Jester Park	S- 28	Polk	220	Des Moines River	36	
Jefferson WTP	S- 46	Greene	89/199	DD 132 to N. Raccoon River	43	
Keosauqua WTP	S-101	Van Buren	--/252	Unnamed Tributary to D.M. River	66	
Knoxville Veterans Admin. Hos.	S- 90	Marion	--/149	White Breast Creek	60	
Knoxville WTP	S- 88	Marion	--/149	Competine Cr. to White Breast Cr.	59	
KOA Campground	S- 67	Polk	--/199	Raccoon River	50	
Kossuth Co. Park	S- 12	Kossuth	42/329	E. Fork Des Moines River	27	
Lake Panorama	S- 56	Guthrie	60/199	Middle Raccoon River	47	
Laurens WTP	S- 39	Pocahontas	105/199	Cedar Creek	40	
Lidderdale WTP	S- 53	Carroll	108/199	Storm Creek	46	
Lovilia WTP	S- 93	Monroe	--/127	S. Coal Cr. to N. Coal Cr.	61	
Lytton WTP	S- 42	Sac	135/199	Camp Cr. to N. Raccoon Riv.	41	
MBZ MHP	S- 83	Clarke	--/176	Squaw Cr. to South River	56	
Madison Co.Home	S- 75	Madison	--/186	Cedar Cr. to North River	52	
Marion County Home	S- 91	Marion	--/149	White Breast Creek	60	
Mel Ray MHP	S- 29	Polk	213	Des Moines River	38	
Menlo WTP	S- 79	Guthrie	--/180	Middle River	54	
Monroe County Park	S- 94	Monroe	--/121	Bluff Creek	61	
Newell WTP	S- 41	Buena Vista	131/199	Prairie Cr. to N. Raccoon Riv.	41	
Natl. Crossroads Campground	S- 65	Dallas	6/199	Walnut Creek	49	
Oak Lake Devel	S-106	Kossuth	52/329	E. Des Moines River	26	
Oak Park MHP	S- 16	Webster	311	Des Moines River	30	
Oakwood Hts. MHP	S- 69	Polk	--/191	Four Mile Creek	51	
Ottumwa WTP	S- 97	Marion	97	Des Moines River	64	
Panora WTP	S- 57	Guthrie	60/199	Middle Raccoon River	47	
Pella WTP	S- 92	Marion	--/141	Sents Creek	60	
Perry WTP	S- 49	Dallas	61/199	N. Raccoon River	44	
Prairie Village	S- 58	Dallas	28/199	Raccoon River	48	
R & R Campground	S- 87	Clarke	--/149	White Breast Cr.	59	
Rabbit Run MHP	S- 98	Wapello	98	Des Moines River	64	
Red Rock Lake View Sub.	S- 89	Marion	--/149	Competine Cr. to White Breast Creek	59	
Regency Manor	S- 35	Polk	--/205	Wafley Creek	38	
Ringsted WTP	S- 8	Emmet	49/329	Black Cat Cr., E. Fork D.M. Riv.	26	
Roadrunner Campgrounds	S- 66	Dallas	6/199	Walnut Creek	50	
Rockwell City Women's Reformatory	S- 43	Calhoun	130/199	Lake Creek	42	
Rolfe WTP	S- 4	Pocahontas	21/329	Pilot Cr. to W. Fork D.M. River	24	
Sac City WTP	S- 38	Sac	156/199	N. Raccoon River	40	
Saylorville Lake Rec. Area	S- 30	Polk	211	Des Moines River	36	
Sentral Comm. School	S- 73	Polk	--/191	Black Cat Creek	26	
S.E. Polk Comm. School	S- 73	Polk	--/191	Four Mile Cr. to D.M. Rover	52	

TABLE V-1
POINT SOURCE
WASTEWATER DISCHARGES

Discharger[1]	Reference Number	County	River Mile[2]	Discharge To[3]	Page Reference Inventory Chapter V	Page Reference Needs VIII
S.E.Polk H.S.	S- 81	Polk	--/177	Mud Creek	55	
S.E. Warren Comm. School	S-109	Warren	--/176	Otter Cr. to South River	57	
S.W. Polk Water Company	S- 60	Polk	--/199	Raccoon River	49	
Springbrook St. Park	S- 54	Guthrie	75/199	Middle Raccoon River	47	
Storm Lake WTP	S- 36	Buena Vista	174/199	Boyer Creek	39	
Sundown Lake Development	S-100	Appanoose	--/ 78	S. Soap Creek	65	
Sugar Valley Campground	S-103	Lee	--/ 6	Sugar Creek	67	
Sunny Brook MHP	S- 71	Polk	--/191	Four Mile Creek	51	
Thomas Mitchell Park	S- 85	Polk	--/176	Camp Creek	57	
Titonka WTP	S- 7	Kossuth	58/329	Buffalo Cr. to E. Fork D.M. Riv.	26	
Town & Country MHP	S- 32	Dallas	--/206	Beaver Creek	37	
Twin Cedar Comm. School	S-110	Marion	--/127	Coal Creek to D.M. River	61	
Twin Lakes Travel Park	S- 44	Calhoun	130/199	Lake Creek	42	
Vista Acres MHP	S- 17	Webster	--/286	DD 54 to D.M. River	32	
Water Dev. Co.	S- 76	Warren	--/186	North River	53	
Webster City WTP	S- 20	Hamilton	--/282	Boone River	34	
West Bend WTP	S- 3	Palo Alto	27/329	Prairie Cr. to W. Fork D.M. Riv.	24	
Winterset WTP	S- 74	Madison	--/186	Cedar Cr. to N. River	52	
Whittemore WTP	S- 13	Kossuth	20/329	Lotts Creek	27	
Woodland Hills MHP	S- 96	Wapello	--/ 98	Bear Creek	64	
Woodward State Institution	S- 27	Boone	--/236	Preston Br. to D.M. River	35	
YMCA Boys Home	S- 31	Polk	210	Des Moines River	36	
Industrial						
Anderson Quarry	I- 7	Humboldt	11/329	W. Fork D.M. River	25	
American Can Co.	I- 22	Webster	314	Des Moines River	30	
American Can Co.	I- 69	Polk	--/205	Des Moines River	38	
American Oil Co.	I- 66	Polk	6/199	Walnut Creek	49	
Armstrong Rubber Co.	I- 70	Polk	1/197	Dean's Lake to D.M. River	50	
Beaver Valley Canning Co.	I- 43	Polk	--/206	Little Beaver Creek	37	37
Bernhold Brother Frozen Foods	I- 58	Kossuth	112/199	Middle Raccoon River	46	
Bituminous Material & Supply Co.	I- 12	Carroll	112/199	Middle Raccoon River	27	
Boone Valley Coop	I- 35	Wright	47/282	DD 94 to Boone River	33	
Buena Vista Cnty. Gravel	I- 53	Buena Vista	131/199	Prairie Cr. to N. Raccoon Riv.	41	

TABLE V-1
POINT SOURCE
WASTEWATER DISCHARGES

Discharger[1]	Reference Number	County	River Mile[2]	Discharge To[3]	Page Reference Inventory Chapter V	Page Reference Needs VIII
Burchett Supper Club	I-110	Davis	--/ 56	Chequest Creek	66	
Carlisle Sand & Gravel	I- 77	Warren	--/186	North River	53	
Carroll Rendering Works	I- 59	Carroll	112/199	Middle Raccoon River	46	
C.D. Hess & Son	I- 88	Marion	--/149	White Breast Creek	59	
Chamberlain Mfg.	I-101	Monroe	--/114	Miller Creek	63	
Champlain Pet. Co.	I- 85	Clarke	--/149	White Breast Creek	58	
Champlain Truck Stop	I- 67	Dallas	6/199	Walnut Creek	50	
Chicago, Milwaukee, St. Paul & Pacific Railroad	I-104	Wapello	--/ 98	Bear Creek	64	
Chicago, R.I. & Pacific Railroad	I- 71	Polk	1/197	Dean's Lake	50	
Clow, Coop, Oskaloosa Plant No. 1	I-100	Mahaska	--/115	Little Muchakinock	63	
Concrete Material Division	I- 82	Clarke	--/176	Squaw Cr. to South River	56	
Concrete Material Division	I- 97	Mahaska	116	Des Moines River	62	
Coates Utility Company	I- 26	Webster	310	Des Moines River	31	
Cook Inc.	I- 11	Kossuth	42/329	E. Fork D.M. River	27	
Corn Belt Power Coop	I- 8	Humboldt	1/329	W. Fork D.M. River	28	
Culligan Water Conditioning	I- 10	Kossuth	42/329	E. Fork D.M. River	27	
Culligan Water Conditioning	I- 23	Webster	312	Des Moines River	30	
Dickey Clay Mfg.	I- 33	Webster	--/295	Crooked Cr. to D.M. River	31	
Douds Stone, Inc. Douds Mine	I-109	Van Buren	--/ 62	Des Moines River	65	
Douds Stone, Inc. Lewis Quarry	I-111	Davis	--/ 56	Chequest Creek	66	
Douds Stone, Inc. Gardner Quarry	I-113	Van Buren	--/ 65	Des Moines River	65	
Douds Stone, Inc. Nedraw Quarry	I-114	Van Buren	--/ 62	Des Moines River	65	
Emmetsburg Rendering Wks.	I- 5	Palo Alto	45/329	W. Fork D.M. River	24	
Estherville Mun. Light Plant	I- 56	Emmet	81/329	W. Fork D.M. River	23	
Firestone Tire & Rubber	I- 46	Polk	--/205	Walfley Creek	38	

TABLE V-1
POINT SOURCE
WASTEWATER DISCHARGES

Discharger[1/]	Reference Number	County	River Mile[2/]	Discharge To[3/]	Page Reference Inventory Chapter V	Needs VIII
Ford Motor Co.	I- 47	Polk	--/205	Closed	38	
Farmegg Prod.	I- 14	Webster	--/322	Bass Cr. to D.M. River	28	
Farmland Ind.	I- 31	Webster	305	Des Moines River	31	37
Farner-Bocken	I- 60	Carroll	112/199	Middle Raccoon River	46	
Fort Dodge Creamery	I- 21	Webster	314	Des Moines River	30	
Franklin Mfg.	I- 37	Hamilton	24/282	Boone River	34	
Frye Copy Sys.	I- 72	Polk	--/197	Dean's Lake to D.M. River	50	
Gendler Stone	I- 64	Dallas	35/199	Bear Creek	48	
Hallett Const.	I- 2	Emmet	79/329	W. Fork D.M. River	23	
Hallett Const.	I- 16	Pocahontas	--/313	N. Branch Lizard Cr.	29	
Hormel & Co.	I- 20	Webster	314	Des Moines River	30	
George A. Hormel	I-105	Wapello	96	Des Moines River	64	
IA Beef Proc.	I- 25	Webster	311	Des Moines River	30	37
Iowa Fund Inc.	I- 44	Polk	--/205	Walfley Creek	38	
IA Industrial Hydraulics Inc.	I- 18	Pocahontas	35/313	Lizard Creek	29	
IA Public Service	I- 36	Wright	47/282	DD 94 to Boone River	33	
IA Power & Light	I- 74	Polk	194	Des Moines River	51	
IA Public Service	I- 61	Carroll	112/199	Middle Raccoon River	46	
IA Public Service	I- 48	Buena Vista	174/199	Boyer Creek	39	
IA Elec. Light & Power	I- 57	Dallas	60/199	N. Raccoon River	45	
IA Southern Utilities	I-102	Monroe	--/114	Miller Creek	63	
Kaser Const. Co.	I- 99	Mahaska	--/115	Little Muchakinock Creek	63	
Kaser Const. Co.	I- 91	Marion	--/140	English Creek	60	
Kaser Const Co.	I- 92	Marion	--/140	English Creek	60	
Kaser Const Co. Eddyville Quarry	I- 96	Monroe	--/116	Gray's Creek	62	
Kaser Const. Co.	I-107	Van Buren	--/ 72	Stump Creek	65	
Kaser Const. Co.	I-108	Van Buren	--/ 68	Unnamed Tributary to D.M. River	65	
Lacona Oil Co.	I- 86	Warren	--/149	Mill Branch Cr. to White Breast Creek	59	
Land O' Lakes	I- 24	Webster	312	Des Moines River	30	
Lennox Ind.	I- 73	Polk	1/197	Dean's Lake to D.M. River	50	
Mahaska Bottling Company	I- 98	Mahaska	--/115	Little Muchakinock Creek	62	
Morrell & Co.	I- 3	Emmet	73/329	W. Fork D.M. River	23	
Martin Marietta Corp. Eddyville Sand Plant	I- 95	Mahaska	117	Des Moines River	62	
Martin Marietta Corp. Ottumwa	I-106	Wapello	93	Des Moines River	64	
Material Serv.	I-103	Wapello	99	Des Moines River	63	

TABLE V-1
POINT SOURCE
WASTEWATER DISCHARGES

Discharger[1/]	Reference Number	County	River Mile[2/]	Discharge To[3/]	Page Reference Inventory Chapter V	Needs VIII
Midwest Limestone	I- 15	Pocahontas	--/313	Lizard Creek	29	
Mefferd Ind., Inc.	I- 52	Pocahontas	105/199	Cedar Creek	40	37
Meredith Corp.	I- 68	Polk	--/199	Raccoon River	50	
Mid-Continent Industries	I- 45	Polk	--/205	Walfley Creek	38	
Natural Gypsum Co.	I- 29	Webster	--/309	Gypsum Cr. to D.M. River	31	
Nickerson Farm	I- 78	Adair	--/180	Middle River	54	
Northern Natural Gas Co.	I- 30	Webster	--/312	Soldier Creek	31	
Northern IA Natural Gas Co.	I- 63	Dallas	37/199	Panther Cr. to S. Raccoon Riv.	48	
Northern IA Natural Gas Co. Redfield	I- 62	Dallas	37/199	Panther Cr. to S. Raccoon Riv.	48	
Northern IA Natural Gas Co.	I- 34	Wright	--/282	Boone River	33	
Osmundson Mfg.	I- 55	Dallas	61/199	N. Raccoon River	44	
Oscar Mayer & Co.	I- 56	Dallas	61/199	N. Raccoon River	45	37
Pella Limestone	I- 93	Mahaska	133	Des Moines River	61	
Pershing Utilities	I- 94	Marion	6/199	Walnut Creek	61	
P & M Stone Co	I- 6	Humboldt	14/329	W. Fork D.M. River	25	
P & M Stone Co	I- 13	Humboldt	--/329	E. Fork D.M. River	28	
Plaines Poultry Farm, Inc.	I- 41	Polk	--/214	Little Creek to Big Creek	36	37
Pocahontas Rendering Co	I- 17	Pocahontas	--/313	Lizard Creek	29	
Sac County Road Gravel	I- 51	Sac	157/199	N. Raccoon River	40	
Sandler Built Homes, Inc.	I- 40	Boone	--/246	Honey Cr. to D.M. River	35	
E.I. Sargent Quarries Inc.	I- 83	Clarke	--/176	S. Squaw Cr. to South River	56	
E.I. Sargent Quarries, Inc.	I- 75	Madison	--/186	Cedar Cr. to North River	52	
E.I. Sargent Quarries Inc.	I- 81	Polk	--/180	Middle River	54	
Schildberg Const.	I- 79	Adair	--/180	Middle River	54	
Schildberg Const.	I- 80	Madison	--/180	Middle River	54	

TABLE V-1
POINT SOURCE
WASTEWATER DISCHARGES

Discharger1/	Reference Number	County	River Mile2/	Discharge To3/	Page Reference Inventory	Page Reference Needs
					Chapter V	VIII
Schildberg Const.	I- 76	Madison	--/186	Cedar Cr. to North River	52	
Shriver-Van Horner	I- 54	Greene	89/199	DD 137 to North Raccoon River	43	
Skelly Oil	I- 65	Polk	6/199	Walnut Cr. to Raccoon River	49	
Stuckeys (I-35)	I- 84	Warren	--/176	Squaw Cr. to South River	56	
Texaco Inc.	I- 4	Palo Alto	48/329	W. Fork D.M. River	23	
Triangle Quarries	I-112	Van Buren	--/ 34	Indian Creek	66	
U.S. Gypsum Co	I- 27	Webster	310	Des Moines River	31	
Wadco Foods, Inc.	I- 1	Emmet	73/329	W. Fork D.M. River	23	
Weaver Const. Co. (Moberly Mine)	I- 39	Hamilton	--/282	Boone River	34	
Webster City Mun. Light & Power	I- 38	Hamilton	23/282	Boone River	34	
Webster Processing	I- 28	Webster	309	Des Moines River	31	
Welp & McCarten	I- 19	Webster	7/313	S. Branch Lizard Creek	29	
Welp & McCarten (Griffeth Quarry)	I- 9	Humboldt	1/329	Indian Cr. to W. Fork D.M. River	25	
Vermeer Mfg. Co.	I- 90	Marion	--/141	Sents Creek	60	
Villas & Co.	I- 49	Buena Vista	174/199	Boyer Creek	39	
Vista Products	I- 50	Buena Vista	174/199	Boyer Creek	39	

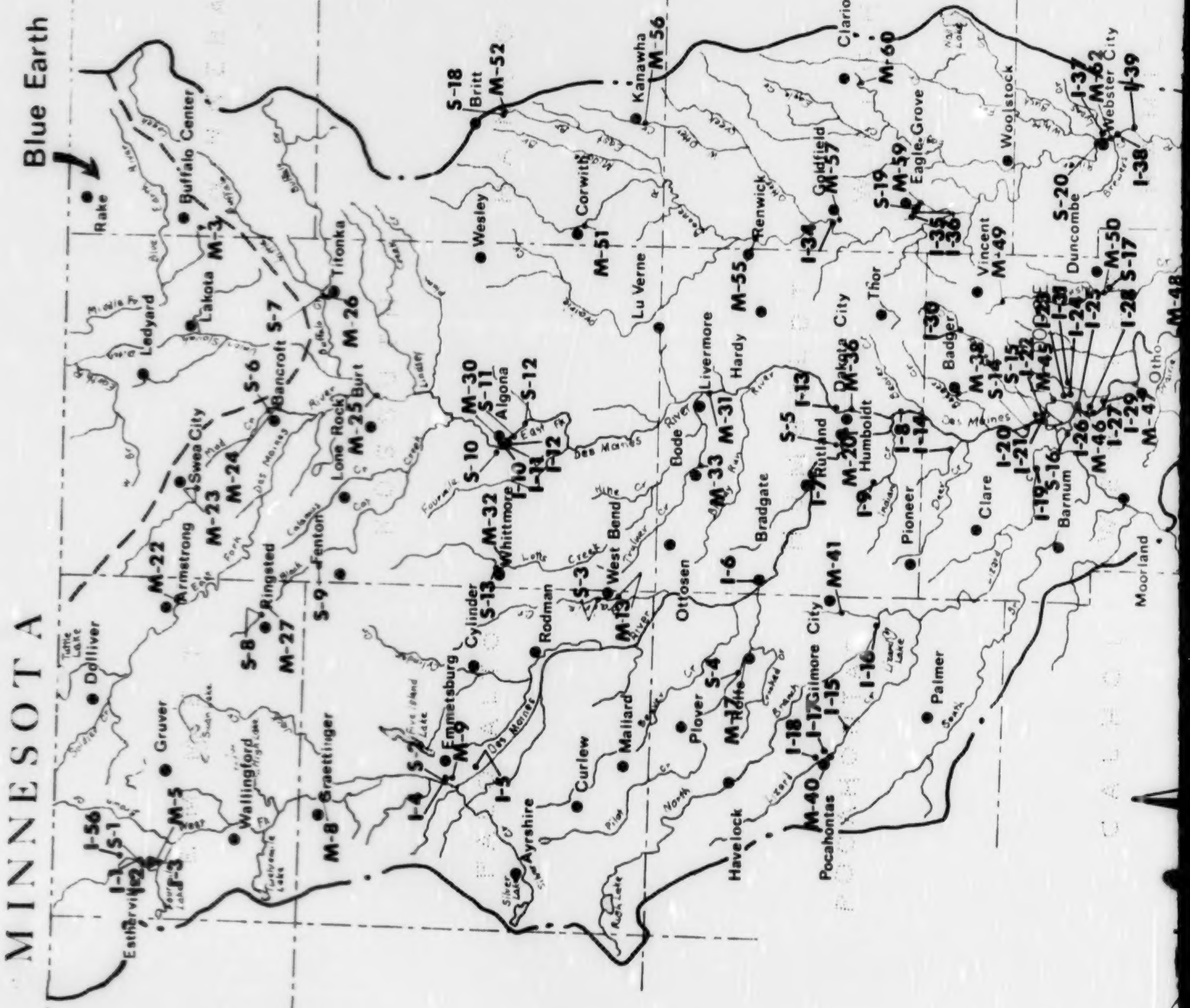
1/ Some abbreviations used include:

H.S. = High School
IA = Iowa
M.H.P. = Mobile Home Park
S.D. = Sanitary District
WTP - Water Treatment Plant
H.H. = Highland Hills

3/ Some abbreviations used include:

Br - Branch
Cr. = Creek
DD = Drainage Ditch
D.M. = Des Moines
NEMTF = No Existing Municipal Treatment Facility
STP = Sewage Treatment Plant

2/ Where two numbers are given, the first number designates the distance of the discharger up the major tributary stream from the Des Moines River. Mile zero is at the confluence of the major tributary stream with the Des Moines. The second number designates the distance up the Des Moines River to where the major tributary stream joins the Des Moines River. Miles zero on the Des Moines is River as at its confluence with the Mississippi River. Mileage values increase, in both cases, going upstream. When only one number is listed, the discharger is directly into the main stem of the Des Moines River. The single number indicates the mileage up the Des Moines River to the point of discharge.


MINNESOTA
Blue Earth
Rake
Buffalo Center
Lakota
Ledyard
Tifonka
Bancroft
Swea City
Armstrong
Dolliver
Gruver
Wallingford
Estherville
Ringsted
Fenton
Lone Rock
Burt
Algona
Whittmore
Cylinder
Emmetsburg
Graettinger
Ayrshire
Curlew
Mallard
Rodman
West Bend
Ottosen
Plover
Rolfe
Havelock
Pocahontas
Gilmore City
Bradgate
Bode
Livermore
Hardy
Lu Verne
Wesley
Corwith
Britt
Kanawha
Renwick
Goldfield
Clarion
Eagle Grove
Woolstock
Webster City
Duncombe
Vincent
Thor
Dakota City
Humboldt
Rutland
Badger
Pioneer
Clare
Barnum
Palmer
Moorland
Otho
Des Moines
I-1
I-2
I-3
I-4
I-5
I-6
I-7
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I-9
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I-11
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I-56
S-1
S-2
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S-16
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S-18
S-19
S-20
M-3
M-5
M-8
M-9
M-13
M-17
M-20
M-22
M-23
M-24
M-25
M-26
M-27
M-30
M-31
M-32
M-33
M-36
M-38
M-40
M-41
M-45
M-46
M-47
M-48
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M-52
M-55
M-56
M-57
M-59
M-60
M-62

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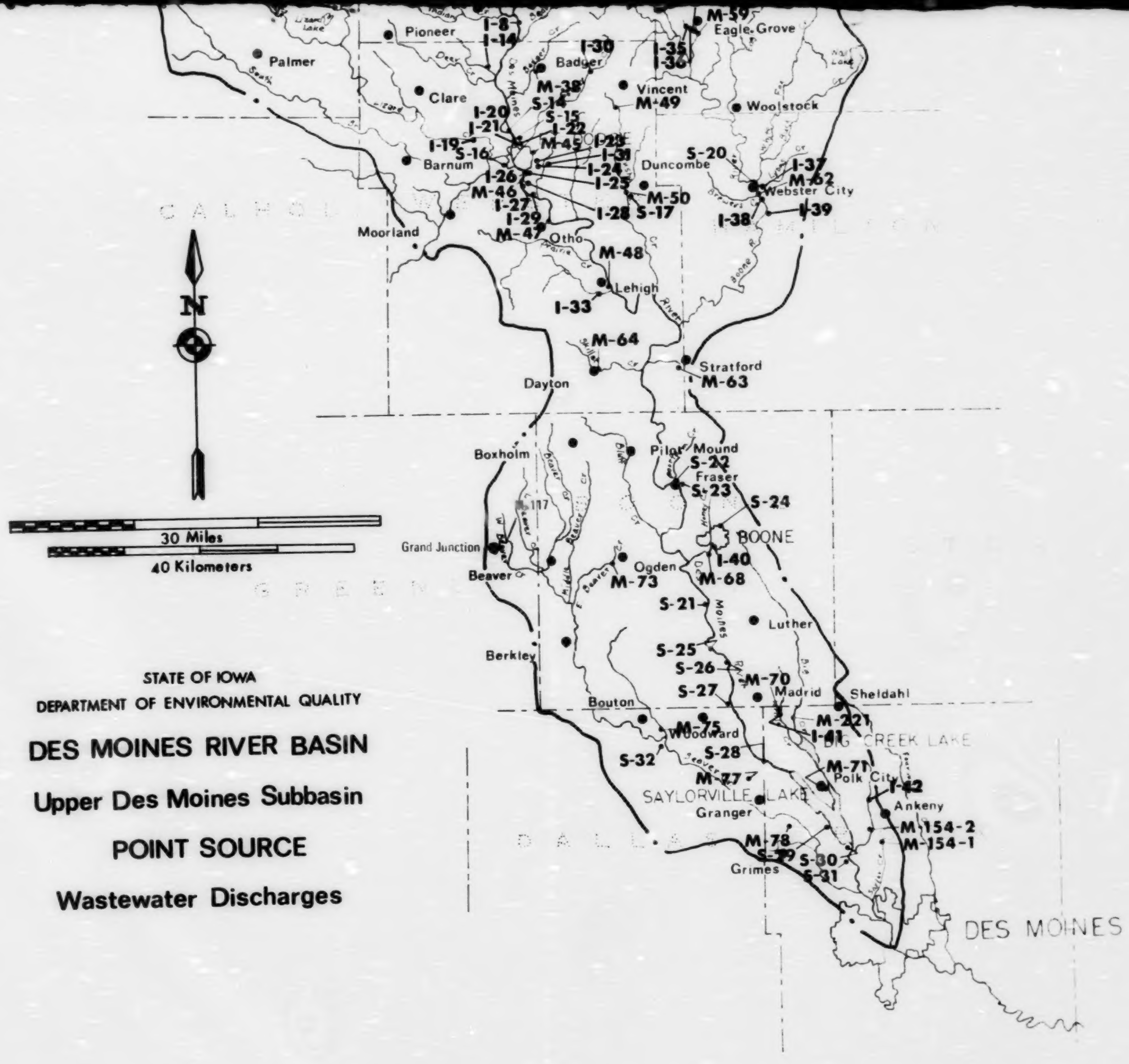
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Palmer
Clare
Barnum
Moorland
Badger
Vincent
Eagle Grove
Woolstock
Duncombe
Webster City
Otho
Lehigh
Dayton
Stratford
Boxholm
Pilot Mound
Fraser
BOONE
Grand Junction
Beaver
Ogden
Luther
Berkley
Bouton
Madrid
Sheldahl
Woodward
BIG CREEK LAKE
SAYLORVILLE LAKE
Polk City
Ankeny
Granger
Grimes
DES MOINES
CALHOUN
HAMILTON
GREENE
DALLAS
Des Moines R.
Boone R.
Lehigh River
N
30 Miles
40 Kilometers
I-8
I-14
I-19
I-20
I-21
I-22
I-23
I-24
I-25
I-26
I-27
I-28
I-29
I-30
I-31
I-33
I-35
I-36
I-37
I-38
I-39
I-40
I-41
I-42
M-38
M-45
M-46
M-47
M-48
M-49
M-50
M-59
M-62
M-63
M-64
M-68
M-70
M-71
M-73
M-75
M-77
M-78
M-221
M-154-2
M-154-1
S-14
S-15
S-16
S-17
S-20
S-21
S-22
S-23
S-24
S-25
S-26
S-27
S-28
S-29
S-30
S-31
S-32
117

STATE OF IOWA
DEPARTMENT OF ENVIRONMENTAL QUALITY

DES MOINES RIVER BASIN

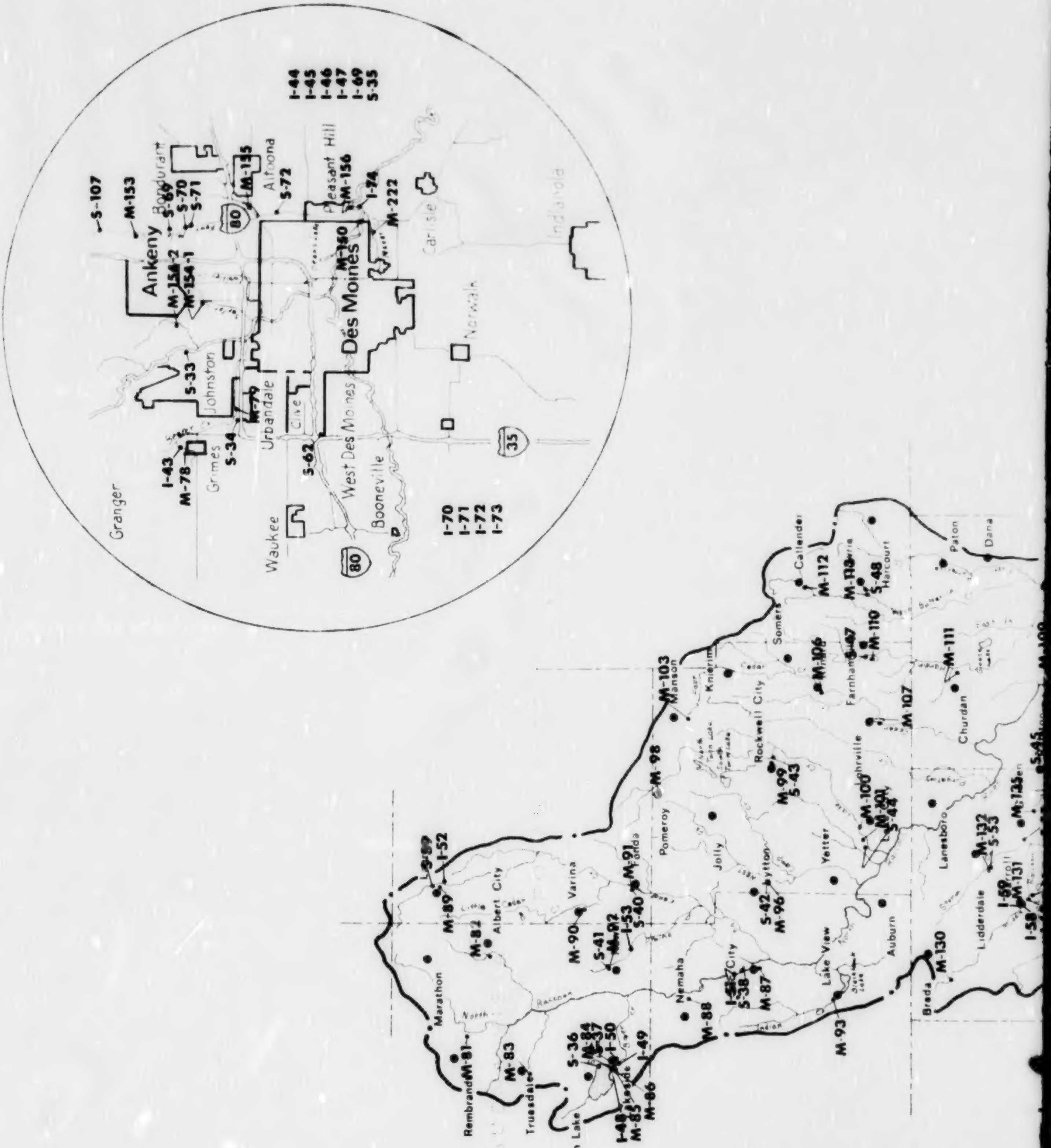
Upper Des Moines Subbasin

POINT SOURCE

Wastewater Discharges

B

FIGURE V-1


Granger
Waukee
Grimes
Johnston
Urbandale
Clive
West Des Moines
Booneville
Ankeny
Bondurant
Altoona
Des Moines
Pleasant Hill
Carlisle
Norwalk
Indianola
80
35
S-107
M-153
S-69
S-70
S-71
M-135
S-72
M-154-2
M-154-1
S-33
I-43
M-78
S-34
M-79
S-62
M-150
M-156
I-74
M-222
I-44
I-45
I-46
I-47
I-69
S-35
I-70
I-71
I-72
I-73
Rembrandt
Marathon
Albert City
Truesdale
Storm Lake
Varina
Fonda
Pomeroy
Manson
Knierim
Somers
Callender
Nemaha
Jolly
Rockwell City
Farnhamville
Harcourt
Lake View
Yetter
Lohrville
Churdan
Paton
Dana
Auburn
Lanesboro
Lidderdale
Breda
Carroll
M-81
M-83
M-84
S-36
S-37
I-50
I-49
I-48
M-85
M-86
M-89
S-39
I-52
M-82
M-90
S-41
M-92
I-53
S-40
M-91
M-88
I-51
S-38
M-87
M-93
M-98
M-103
S-42
M-96
M-99
S-43
M-100
M-101
S-44
M-106
S-47
M-110
M-112
M-113
S-48
M-107
M-111
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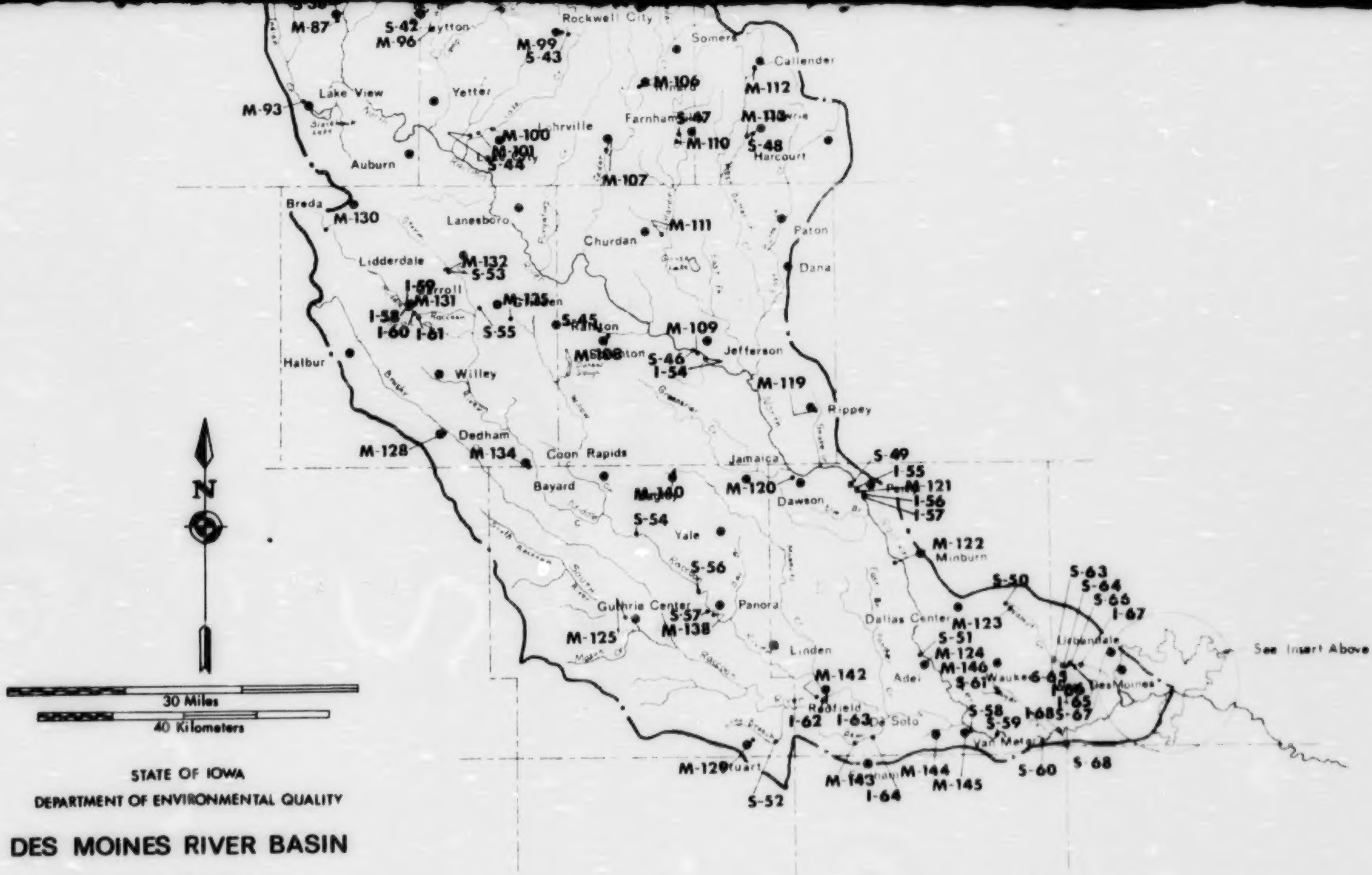
M-131
I-59
I-58
M-132
S-53
M-133
S-45

A


M-87
S-42
Lytton
M-96
Rockwell City
M-99
S-43
Somers
Callender
M-106
M-112
Lake View
M-93
Yetter
Lohrville
M-100
M-101
S-44
Farnham
S-47
M-110
M-113
S-48
Harcourt
Auburn
M-107
Breda
M-130
Lanesboro
Churdan
M-111
Paton
Lidderdale
M-132
S-53
Dana
I-59
Carroll
M-131
M-135
I-58
I-60
I-61
S-55
S-45
M-109
Jefferson
M-108
S-46
I-54
Halbur
Willey
M-119
Rippey
M-128
Dedham
M-134
Coon Rapids
Jamaica
S-49
I-55
M-121
I-56
I-57
Bayard
M-140
M-120
Dawson
S-54
Yale
M-122
Minburn
S-56
S-50
S-63
S-64
S-66
I-67
Guthrie Center
S-57
M-138
Panora
Dallas Center
M-123
M-125
S-51
M-124
Linden
M-146
Urbandale
See Insert Above
M-142
Adel
S-61
Waukee
S-65
Des Moines
I-65
Redfield
S-58
S-59
I-68
S-67
I-62
I-63
De Soto
Van Meter
M-129
Stuart
M-143
M-144
S-60
S-68
M-145
I-64
S-52
N
30 Miles
40 Kilometers

STATE OF IOWA
DEPARTMENT OF ENVIRONMENTAL QUALITY

DES MOINES RIVER BASIN

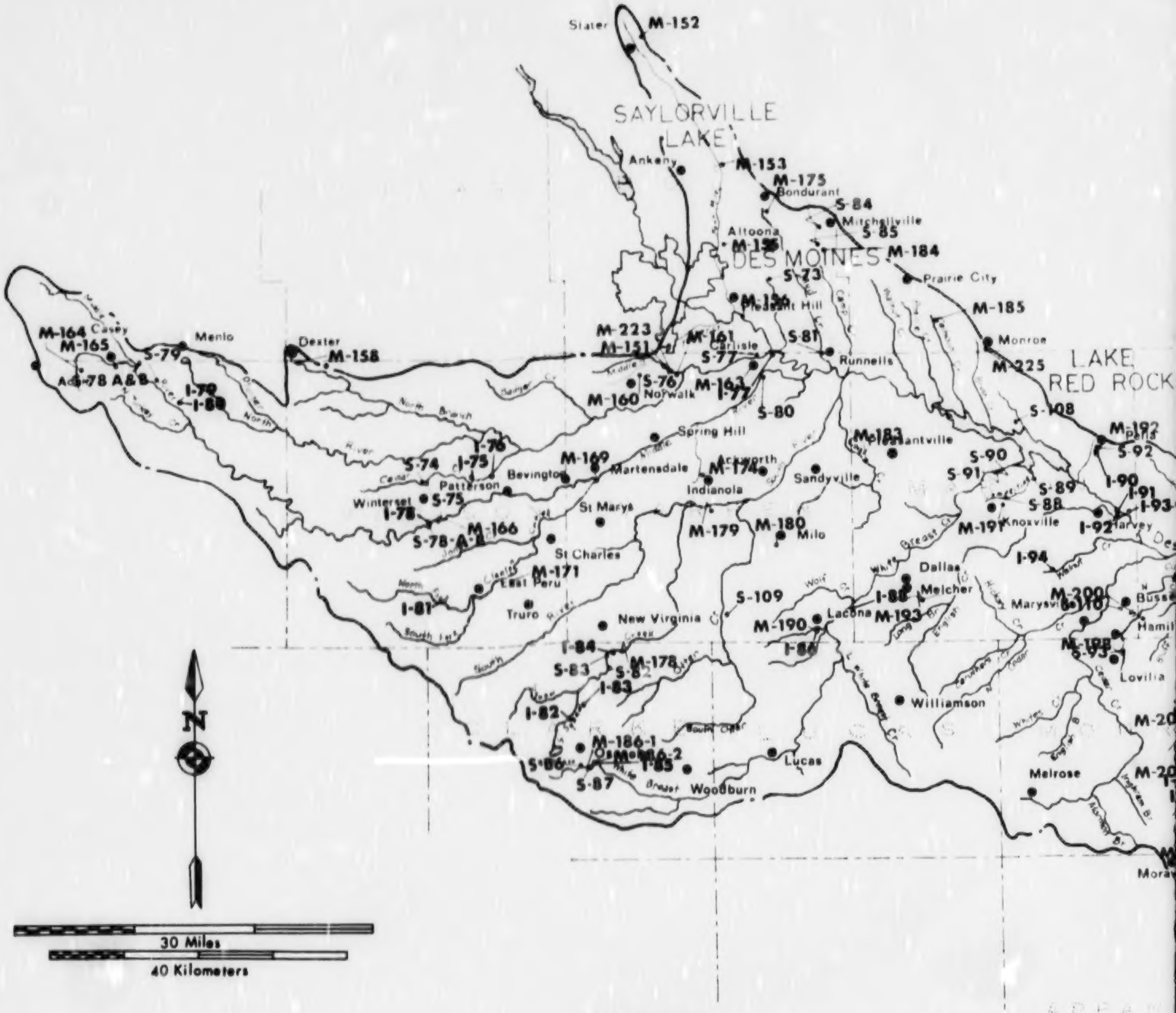
Raccoon Subbasin

B

POINT SOURCE

Wastewater Discharges

FIGURE V-2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M-152
SAYLORVILLE LAKE
Ankeny
M-153
M-175
Bondurant
S-84
Mitchellville
S-85
Altoona
M-155
DES MOINES
M-184
Prairie City
S-73
M-156
Pleasant Hill
M-185
M-223
M-151
M-161
Carlisle
S-81
Runnells
Monroe
M-225
LAKE RED ROCK
S-77
S-76
M-162
I-77
M-160
Norwalk
S-80
S-108
M-164
Casey
M-165
Menlo
Dexter
M-158
S-79
Adair
S-78 A&B
I-79
I-80
North Branch
Badger Cr.
North River
Middle River
Spring Hill
M-183
Pleasantville
M-192
Pella
S-92
I-76
S-74
I-75
M-169
Martensdale
Bevington
Patterson
Ackworth
M-174
Indianola
Sandyville
S-90
S-91
S-89
S-88
I-90
I-91
I-93
Winterset
S-75
I-78
St Marys
Knoxville
M-191
I-92
Harvey
S-78-A-B
M-166
M-179
M-180
Milo
I-94
St Charles
M-171
East Peru
Dallas
Melcher
M-200
I-81
Truro
S-109
I-88
New Virginia
M-190
Lacona
M-193
Marysville
I-84
I-89
Bussey
Hamilton
M-178
S-83
S-82
M-198
S-93
Lovilia
I-83
Williamson
I-82
White Breast Cr.
M-186-1
M-186-2
S-86
I-85
S-87
Lucas
Woodburn
Melrose
Moravia
South Fork
North Fork
Clanton Cr.
Cedar Cr.
Whitebreast Cr.
English Cr.
Wolf Cr.
Long Br.
N
30 Miles
40 Kilometers

STATE OF IOWA
DEPARTMENT OF ENVIRONMENTAL QUALITY

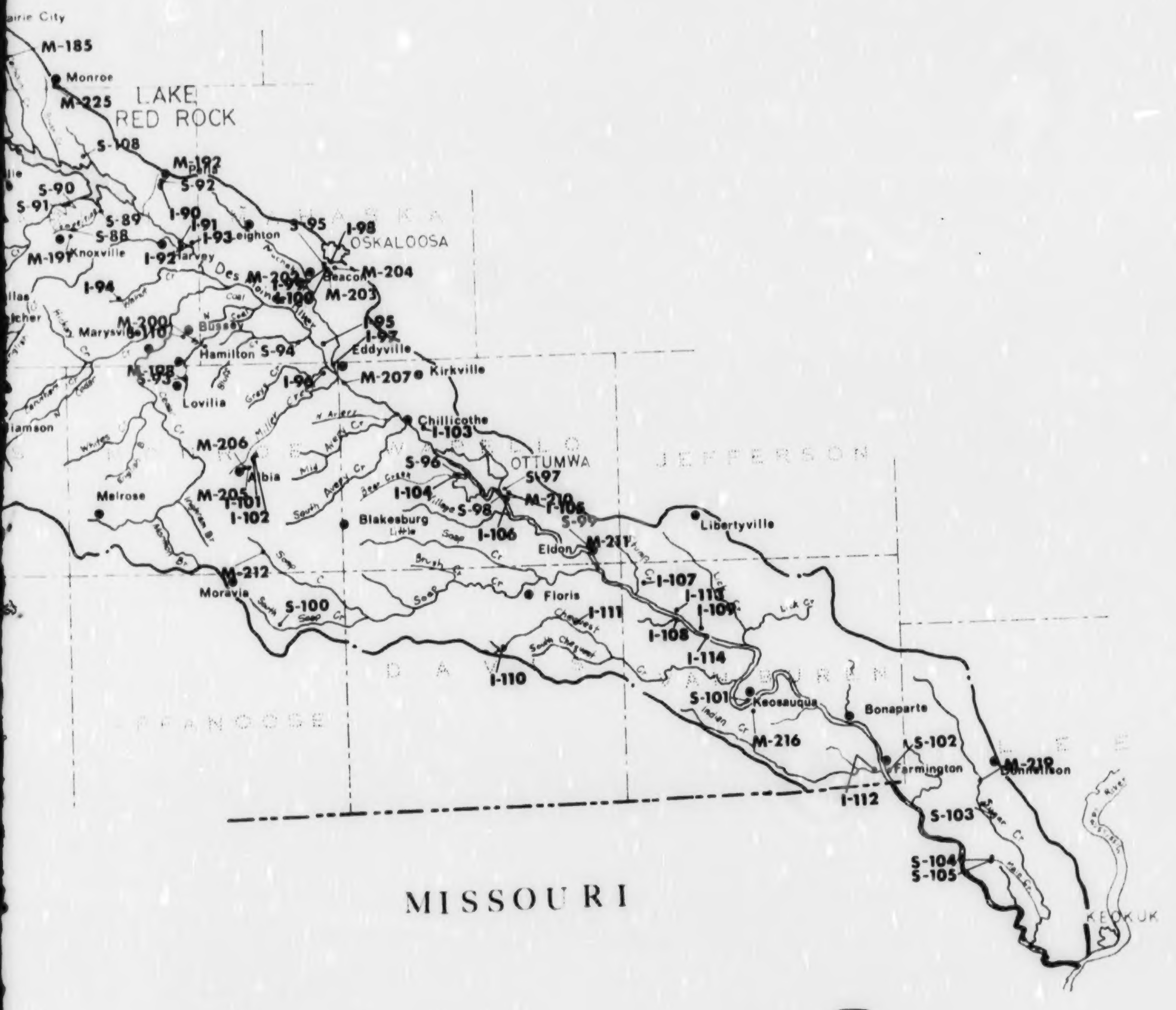
DES MOINES RIVER BASIN

Lower Des Moines Subbasin

POINT SOURCE

Wastewater Discharges

A


Prairie City
M-185
Monroe
M-225
LAKE RED ROCK
S-108
M-192
Pella
S-92
S-90
S-91
S-89
S-88
M-191
Knoxville
I-90
I-91
I-93
Leighton
I-92
Harvey
S-95
I-98
OSKALOOSA
MAHASKA
M-202
Beacon
M-204
I-99
I-100
M-203
Des Moines River
I-94
Coal
M-200
S-110
Marysville
Bussey
Hamilton
S-94
I-95
I-97
Eddyville
M-198
S-93
Lovilia
I-96
M-207
Kirkville
Chillicothe
I-103
Williamson
Miller Cr
N Avery
Avery Cr
Mid
M-206
Albia
MONROE
WAPELLO
JEFFERSON
OTTUMWA
S-96
S-97
I-104
M-210
I-105
S-98
I-106
S-99
Melrose
M-205
I-101
I-102
South Avery Cr
Bear Creek
Blakesburg
Little Soap Cr
Libertyville
Eldon
M-211
M-212
Moravia
Soap Cr
Brush Cr
Floris
I-107
I-113
I-109
Lick Cr
S-100
South Soap Cr
I-111
Chequest
I-108
South Chequest
I-114
I-110
DAVIS
VAN BUREN
APPANOOSE
S-101
Keosauqua
Bonaparte
Indian Cr
M-216
S-102
Farmington
M-219
Donnellson
LEE
I-112
S-103
Sugar Cr
S-104
S-105
Des Moines River
KEOKUK
MISSOURI

B

FIGURE V-3

Table V-2
DISCHARGE INVENTORY **

Discharger (Ref. No.)	1970 Pop.	Design P.E.	Effluent Flow (mgd) Average/Design	Effluent BOD_5 (mg/l)/(lb/day)	Effluent Ammonia-N (mg/l)/(lb/day)	Treatment Type Sludge Disposal	Comments
Blue Earth River							
West Fork Blue Earth							
Union Slough Outlet							
D.D. 80							
Ledyard M-1	240	--	---	---	---	NEMTF	
Union Slough Outlet							
Lakota M-2	385	--	---	---	---	NEMTF	Past information indicates water pollution problem may exist from septic tank discharge.
Blue Earth River							
D.D. 7							
Buffalo Center M-3	1,118	1,250	.100/.165	35/29	8/7	Two Cell Lagoon Not Applicable	12.78 acres. Built in 1967
Blue Earth River							
Coon Creek							
D.D. 64							
Rake M-4	324	--	---	---	---	NEMTF	Waste stabilization pond planned. Grant application has been submitted.

Table V-2
DISCHARGE INVENTORY

Discharger (Ref. No.)	1970 Pop.	Design P.E.	Effluent Flow (mgd) Average/Design	Effluent BOD_5 (mg/l)/(lb/day)	Effluent Ammonia-N (mg/l)/(lb/day)	Treatment Type Sludge Disposal	Comments
West Fork Des Moines River							
Estherville Muni. Light Plant I-56	—	—	.057/NA	---	---	None	Cooling water discharge
Wadco Foods I-1	—	—	0.30/NA	14/35	NA/NA	---	Discharges to Estherville STP
Hallett Const. Co. I-2	—	—	0.050/NA	---	---	Settling pond	Sand and gravel wash
Estherville WTP S-1	—	—	.090/NA	---	---	None	Backwash from softeners and filters.
Estherville M-5	8,108	91,200	2.025/4.84	135/2,280	33/557	Trickling Filter Disposal to Land	Advanced treatment plant under construction.
Morrell & Co. I-3	—	—	0.37/NA	150/463	---	Four Cell Lagoon Not Applicable	Total retention lagoon for boiler blow down, scald water, and dehair water only, other wastes discharged to Estherville STP. To be abandoned.
D.D. 60							
Gruver M-6	135	—	---	---	---	NEMTF	
West Fork Des Moines River							
Wallingford M-7	245	—	---	---	---	NEMTF	Preliminary Engineering report submitted October, 1969.
Graettinger M-8	907	1,343	0.185/0.246	35/54	2/3	Two Cell Lagoon Not Applicable	Constructed in 1968
Emmetsburg WTP S-2	—	—	NA/0.044	---	---	None	Iron and manganese filter backwash, discharge every other day.
Texaco, Inc. I-4	—	—	---	---	---	None	Storm water runoff from tank farm.

Table V-2
DISCHARGE INVENTORY

Discharger (Ref. No.)	1970 Pop.	Design P.E.	Effluent Flow (mgd) Average/Design	Effluent BOD_5 (mg/l)/(lb/day)	Effluent Ammonia-N (mg/l)/(lb/day)	Treatment Type Sludge Disposal	Comments
Emmetsburg M-9	4,150	4,300	0.222/0.266	40/74	15/28	Trickling Filter Disposal to Land	Plant overloaded, consent order in effect. Plans have been approved.
Emmetsburg Rendering Works I-5			——— CLOSED ———				
Silver Creek							
Ayshire M-10	243	--	---	---	---	NEMTF	
Cylinder Creek							
Cylinder M-11	133	--	---	---	---	NEMTF	
Rodman M-12	104	--	---	---	---	NEMTF	
Prairie Creek							
West Bend WTP S-3	--	--	NA/0.010	---	---	None	Iron removal filter backwash discharge once a week.
West Bend M-13	865	740	0.077/0.111	35/22	7/4	Imhoff Tank and Trickling Filter Open Drying Beds	Constructed during 1940's, plant in poor condition.
Beaver Creek							
Curlew M-14	95	--	---	---	---	NEMTF	
Mallard M-15	384	600	NA/0.054	NA	NA		3 cell lagoon to be constructed, permit issued in 1973. Design data given is for a New facility.
Pilot Creek							
Plover M-16	129	--	---	---	---	NEMTF	
Rolfe WTP S-4	--	--	0.02/NA	---	---	None	pH 8.5
Rolfe M-17	767	900	0.032/0.085	40/11	10/3	Two Cell Lagoon Not Applicable	Plant put into operation in 1970.

Table V-2
DISCHARGE INVENTORY

Discharger (Ref. No.)	1970 Pop.	Design P.E.	Effluent Flow (mgd) Average/Design	Effluent BOD$_5$ (mg/l)/(lb/day)	Effluent Ammonia-N (mg/l)/(lb/day)	Treatment Type Sludge Disposal	Comments
West Fork Des Moines River							
Bradgate M-18	130	--	---	---	---	NEMTF	
P & M Stone, Inc. (Bradgate Quarry) I-6	--	--	5.04/NA	---	---	Sedimentation basin	Basin for rock washing, also quarry dewatering Sec. 15 & 16, T92, R30, S.S. 160 mg/l.
Rutland M-19	215	--	---	---	---	NEMTF	
Welp & McCarten, Inc. (Anderson Quarry) I-7	--	--	1.00/NA	---	---	None	Quarry dewatering NE¼, Sec. 35, T92, R29, S.S. 38 mg/l.
Humboldt WTP S-5	--	--	0.010/NA	---	---	None	4 separate discharge lines, new facility being built.
Humboldt M-20	4,665	5,600	0.683/0.929	20/114	8/46	Trickling Filter Wet Haul Farmland	Preliminary Engineering Report 1973
Indian Creek							
Welp & McCarten, Inc. (Griffith Quarry) I-9	--	--	1.0/NA	---	---	None	Quarry Dewatering, S.S. 26 mg/l
East Fork Des Moines River							
Soldier Creek							
Dolliver M-21	95	--	---	---	---	NEMTF	
East Fork Des Moines River							
Armstrong M-22	1,061	1,300	0.089/0.175	30/22	1/.7	Two Cell Lagoon Not Applicable	Plant placed in operation in 1966.
Mud Creek							
Swea City M-23	774	919	0.047/0.063	45/18	11/4	Two Cell Lagoon Not Applicable	Constructed in 1969

Table V-2
DISCHARGE INVENTORY

Discharger (Ref. No.)	1970 Pop.	Design P.E.	Effluent Flow (mgd) Average/Design	 BOD$_5$ (mg/1)/(1b/day)	 Ammonia-N (mg/1)/(1b/day)	Treatment Type Sludge Disposal	Comments
Bancroft WTP S-6	--	--	NA/NA	---	---	None	Iron and manganese backwash
Bancroft M-24	1,103	1,320	0.099/0.169	80/66	22/18	Imhoff Tank, Sand Filter Open Drying Beds	Planned lagoon to replace existing plant-
East Fork Des Moines River							
Burt M-25	608	743	0.157/0.074	43/56	5/7	Two Cell Lagoon Not Applicable	Constructed in 1964
Buffalo Creek							
Titonka WTP S-7	--	--	0.09/NA	---	---	None	Softening and filter backwash
Titonka M-26	599	1,550	0.056/0.115	35/16	22/10	Trickling Filter Single Cell Lagoon None	6.75 acres
East Fork Des Moines River							
Oak Lake Development S-106	--	--	---	---	---	NEMTF	One acre lagoon for 100 P.E. planned Permit approved Feb. 1973.
Black Cat Creek							
Ringsted WTP S-8	--	--	NA/NA	---	---	None	
Ringsted M-27	509	650	0.043/0.077	25/9	3/1	Two Cell Lagoon Not Applicable	Placed in operation in 1969
Sentral Community School S-9	--	60	NA/0.006	---	---	Imhoff tank, Trickling Filter Unknown	Constructed in 1957
Fenton M-28	403	--	---	---	---	NEMTF	Preliminary Engineering Report submitted in 1967

Table V-2
DISCHARGE INVENTORY

Discharger (Ref. No.)	1970 Pop.	Design P.E.	Effluent Flow (mgd) Average/Design	Effluent BOD_5 (mg/1)/(1b/day)	Effluent Ammonia-N (mg/1)/(1b/day)	Treatment Type Sludge Disposal	Comments
Calmus Creek							
Lone Rock M-29	166	--	---	---	---	NEMTF	
East Fork Des Moines River							
Algona WTP S-10	--	--	0.03/NA	---	---	None	Filter backwash, flows occur 3 days/week
Algona M-30	6,032	8,900	0.552/0.655	40/184	8/37	Trickling Filter Disposal to Land	Constructed in 1954. Heavy Metals reported in effluent.
Culligan Water Conditioning I-10	--	--	0.01/0.05	---	---	None	Backwash from regeneration of softeners and exchange units.
Cook, Inc. I-11	--	--	NA/NA	---	---	None	Water used in cooling gas tanks dumped into storm sewer.
Bituminous Mat. & Supply Co. I-12	--	--	NA/NA	---	---	None	Zeolite softener backwash
Burr Oak Manor S-11	--	--	NA/0.015	---	---	Activated Sludge Unknown	
Kossuth County Park S-12	--	--	NA/0.002	---	---	Septic Tank & Tile Field Disposal to Land	
Livermore M-31	510	720	0.033/0.110	30/8	2/.6	Two Cell Lagoon Not Applicable	Placed in operation in 1968.
Lotts Creek							
Whittemore WTP S-13	--	--	0.024/NA	---	---	None	Backwash from softeners & iron removal units.
Whittemore M-32	658	2,328	0.251/0.147	75/157	2/4	Trickling Filter Open Drying Beds	Plant constructed in 1960.

Table V-2
DISCHARGE INVENTORY

Discharger (Ref. No.)	1970 Pop.	Design P.E.	Effluent Flow (mgd) Average/Design	 BOD$_5$ (mg/l)/(lb/day)	 Ammonia-N (mg/l)/(lb/day)	Treatment Type Sludge Disposal	Comments
Trulner Creek							
Bode M-33	372	490	0.017/0.050	45/6	6/.9	Two Cell Lagoon Not Applicable	
Bloody Run Creek							
Ottosen M-34	93	--	---	---	---	NEMTF	
East Fork Des Moines River							
D.D. 4							
Hardy M-35	73	--	---	---	---	NEMTF	
East Fork Des Moines River							
P & M Stone, Inc. (Hodge Quarry) I-13	--	--	0.36/NA	---	---	Sedimentation Basin	Quarry dewatering NE¼, Sec. 32, T92, R28.
Dakota City M-36	746	1,000	0.044/0.100	35/13	10/4	Trickling Filter Wet Haul to Farmland	Constructed in 1958
Des Moines River							
Corn Belt Power Coop I-8	--	--	30.00/NA	---	---	None	Cooling water discharge only
Bass Creek							
Farmegg Production, Inc. I-14	--	--	---	---	---	One Cell Lagoon Not Applicable	Completed in 1970, complete retention lagoon
Deer Creek							
Pioneer M-37	56	--	---	---	---	NEMTF	
Badger Creek							
Badger M-38	465	450	0.032/0.045	35/9	10/3	Two Cell Lagoon Not Applicable	First cell completed in 1961, second cell constructed in 1968

Table V-2
DISCHARGE INVENTORY

Discharger (Ref. No.)	1970 Pop.	Design P.E.	Effluent Flow (mgd) Average/Design	Effluent BOD$_5$ (mg/1)/(1b/day)	Effluent Ammonia-N (mg/1)/(1b/day)	Treatment Type / Sludge Disposal	Comments
Lizard Creek							
Pocahontas Rendering Co. I-17	--	--	---	---	---	---	Entire waste discharge to Municipal STP.
Iowa Industrial Hydraulics, Inc. I-18	--	--	---	---	---	---	Going to Municipal STP
Pocahontas M-40	2,338	3,175	0.236/0.156	40/79	6/12	Trickling Filter Open Drying Beds	Built 1951, Preliminary report being prepared for new plant.
Midwest Limestone Co. I-15	--	--	.050/NA	---	---	None	Limestone quarry dewatering
North Branch Lizard Creek							
Havelock M-39	248	--	---	---	---	NEMTF	
Hallett Const. I-16	--	--	1.5/NA	---	---	None	Quarry dewatering Sec. 36, T 92, R 31W.
D.D. 168							
Gilmore City M-41	766	1,000	0.087/0.100	30/22	6/4	Two Cell Lagoon Not Applicable	Constructed in 1959
Lizard Creek							
Clare M-42	249	300	NA/.030	NA	NA	Three Cell Lagoon Not Applicable	Under construction
South Branch Lizard Creek							
Palmer M-225	246	--	---	---	---	NEMTF	
Barnum M-43	147	--	---	---	---	NEMTF	Preliminary report submitted
Welp & McCarten, Inc. I-19	--	--	.123/NA	---	---	Settling pond	Quarry dewatering, Fort Dodge Quarry Sec 23, T89, R29

Table V-2
DISCHARGE INVENTORY

Discharger (Ref. No.)	1970 Pop.	Design P.E.	Effluent Flow (mgd) Average/Design	Effluent BOD$_5$ (mg/1)/(lb/day)	Effluent Ammonia-N (mg/1)/(lb/day)	Treatment Type Sludge Disposal	Comments
Spring Creek							
Moorland M-44	269	--	---	---	---	NEMTF	
Des Moines River							
Fort Dodge Muni. Airport S-14	--	--	.0085/NA	---	---	One Cell Lagoon Not Applicable	Total retention except during wet weather.
Hormel & Co. I-20	--	--	.315/NA	---	---	None	Process and Sanitary Wastes to Municipal STP, Cooling water discharge to River.
Fort Dodge WTP S-15	--	--	0.150/NA	---	---	None	Filter backwash, S.S. 17 mg/1
Fort Dodge Creamery I-21	--	--	0.200/NA	---	---	---	To Fort Dodge STP
American Can Co. I-22	--	--	0.02/NA	---	---	None	Cooling water discharge only
Fort Dodge M-45	31,263	184,000	3.367/5.30	38/1,067	15/421	Two Stage Trickling Filter Disposal to Farmland	Plant expansion under const.
Oak Park MHP S-16	--	--	NA	---	---	Extended aeration/ Polishing pond Unknown	
Culligan Water Conditioning I-23	--	--	NA	---	---	None	Direct discharge to backwash water.
Land O' Lakes I-24	--	--	0.46/NA	15/58	2/7.7	None	Sewage and Process wastes to Municipal system, cooling water to stream.
IA Beef Processors I-25	--	--	1.00/1.20	190/1,580	108/900	Anaerobic/Aerobic Lagoon System Not Applicable	Built in 1970, no discharge allowed when river flow is less than 40 cfs.

Table V-2
DISCHARGE INVENTORY

Discharger (Ref. No.)	1970 Pop.	Design P.E.	Effluent			Treatment Type Sludge Disposal	Comments
			Flow (mgd) Average/Design	BOD$_5$ (mg/l)/(lb/day)	Ammonia-N (mg/l)/(lb/day)		
Coats Utility Co. I-26	52	406	NA/0.0095	—	—	One Cell Lagoon Not Applicable	Built 1970, to handle Webster Co. Home and residential development.
Savage Sanitary Dist. M-46	522	522	NA/0.05	25/—	10/—	Aerated Lagoon Not Applicable	Built in 1968, redesigned in 1971 for total retention
U.S. Gypsum Co. I-27	—	—	.223/NA	—	—	None	Direct discharge to River.
Webster Processing Co. I-28	—	—	NA/0.05	—	—	One Cell Lagoon Not Applicable	Constructed in 1968
National Gypsum Co. I-29	—	—	.078/NA	—	—	None	Direct discharge to River
Otho M-47	581	440	0.057/0.044	35/17	3/1.4	Two Cell Lagoon Not Applicable	Constructed in 1966
Soldier Creek							
Northern Natural Gas Co. I-30	—	—	.090/NA	—	—	None	
Holiday Creek							
Farmland Industries I-31	—	—	0.60/NA	10/50	18/88	One Cell Lagoon Not Applicable	Max. discharge 100 lb/day ammonia
Crooked Creek							
Lehigh M-48	739	748	0.047/0.151	35/14	2/.8	Two Cell Lagoon Not Applicable	
Dickey Clay Mfg. I-33	—	—	0.054/NA	—	—	None	Will route sewage to Lehigh STP in the future.
Brushy Creek							
Vincent M-49	204	270	NA/0.027	—	—	Two Cell Lagoon Not Applicable	Completed in 1972
Duncombe M-50	418	400	0.022/0.034	30/5.5	2/.4	Two Cell Lagoon Not Applicable	Placed operation in 1967 3.44 acres

Table V-2
DISCHARGE INVENTORY

Discharger (Ref. No.)	1970 Pop.	Design P.E.	Effluent			Treatment Type Sludge Disposal	Comments
			Flow (mgd) Average/Design	BOD$_5$ (mg/l)/(lb/day)	Ammonia-N (mg/l)/(lb/day)		
D.D. 54							
Vista Acres MHP S-17	--	--	NA	---	---	Extended aeration w/polishing pond No Sludge Waste	
Boone River							
Corwith M-51	407	600	0.023/0.091	35/7	1/.2	Two Cell Lagoon Not Applicable	Constructed in 1971
Middle Branch Boone River							
Britt WTP S-18	--	--	0.229/NA	---	---	None	Filter backwash
Britt M-52	2,069	2,069	0.242/0.18	40/80	2/4	Trickling Filter Disposal to Land	Built in 1935, plant in poor condition, lagoon site has been approved.
Boone River							
Prairie Creek							
Wesley M-53	548	--	---	---	---	NEMTF	Preliminary Report submitted 1967.
Luverne M-54	380	430	NA/.043	---	---	NEMTF	Three cell lagoon facility is planned. Permit has been issued. Parameters shown are design values.
Joint Drainage Ditch 3							
Renwick M-55	429	3,240	0.076/0.096	30/19	4/2.5	Two Cell Lagoon Not Applicable	Built 1962
Otter Creek							
W. Otter Creek							
Kanawha M-56	808	780	0.083/0.087	40/28	1/.7	Two Cell Lagoon Not Applicable	Waste stabilization lagoon constructed in 1970.

Table V-2
DISCHARGE INVENTORY

Discharger (Ref. No.)	1970 Pop.	Design P.E.	Effluent Flow (mgd) Average/Design	Effluent BOD$_5$ (mg/l)/(lb/day)	Effluent Ammonia-N (mg/l)/(lb/day)	Treatment Type Sludge Disposal	Comments
Boone River							
Goldfield M-57	722	3,900	0.024/0.219	50/10	4/.8	Two Cell Lagoon Not Applicable	Constructed in 1963, 34 acres, Sec. 28, T 91, R 26
Northern Natural Gas Co. I-34	--	--	.0025/NA	---	---	None	
D.D. 3							
Thor M-58	212	--	---	---	---	NEMTF	Plans are being prepared for lagoon system.
D.D. 94							
Boone Valley Coop I-35	--	--	.155/NA	---	---	None	Cooling water discharge only. Sanitary and process wastes to Eagle Grove STP.
Iowa Public Service I-36	--	--	.016/NA	---	---	None	Cooling water discharge only.
Eagle Grove WTP S-19	--	--	.026/NA	---	---		Process water from lime treatment pH 11.
Eagle Grove M-59	4,489	4,180	0.652/0.504	52/283	20/109	Trickling Filter Plant Wet Haul to Farmland	Plant is overloaded and frequent by-pass of raw sewage.
Eagle Creek							
D.D. 2							
Clarion M-60	2,472	3,000	0.261/0.145	60/131	16/35	Trickling Filter Plant Wet Haul to Farmland	Built in 1934.
Eagle Creek							
Woolstock M-61	222	--	---	---	---	NEMTF	Preliminary plans submitted for lagoon system in 1967.

Table V-2
DISCHARGE INVENTORY

Discharger (Ref. No.)	1970 Pop.	Design P.E.	Effluent Flow (mgd) Average/Design	Effluent BOD_5 (mg/1)/(1b/day)	Effluent Ammonia-N (mg/1)/(1b/day)	Treatment Type Sludge Disposal	Comments
Boone River							
Webster City WTP S-20	--	--	.029/NA	---	---	Settling Basin	Lime-Soda Ash softening sludge
Webster City M-62	8,488	12,000	1.582/1.50	25/330	15/198	Trickling Filter Plant Disposal to Land	Expansion in 1963, 1973 preliminary report recommends further expansion.
Franklin Mfg. I-37	--	--	.46/NA	20/77	.8/3	Holding Lagoon	
Webster City Municipal Light & Power I-38	--	--	11.52/11.52	---	---	None	Cooling water only
Weaver Const. Co. (Moberly Mine) I-39	--	--	3.6/NA	---	---	None	Pumping surface water at mine surface
Des Moines River							
Stratford M-63	710	700	0.060/0.070	25/13	10/5	Extended Aeration Polishing Pond Unknown	Built in 1965, existing sewers have high infiltration
Skillet Creek							
Dayton M-64	909	900	0.150/0.084	40/50	6/7.5	Trickling Filter Wet Haul to Farmland	Built in 1956 and in poor condition, under consent order for in-plant modifications.
Poor Farm Creek							
Boone Co. Home S-22	--	--	NA/0.008	---	---	One Cell Lagoon Not Applicable	Constructed in 1967
Episcopal Center & Conference Camp S-23	--	--	NA/0.007	---	---	Septic Tank Unknown	Permit issued 1/18/73 to construct waste stabilization pond.
Des Moines River							
Fraser M-65	143	--	---	---	---	NEMTF	

Table V-2
DISCHARGE INVENTORY

Discharger (Ref. No.)	1970 Pop.	Design P.E.	Effluent Flow (mgd) Average/Design	Effluent BOD$_5$ (mg/l)/(lb/day)	Effluent Ammonia-N (mg/l)/(lb/day)	Treatment Type / Sludge Disposal	Comments
Bluff Creek							
Boxholm M-66	242	--	---	---	---	NEMTF	Final plans submitted 11/26/73 for waste stabilization lagoon.
Pilot Mound M-67	214	--	---	---	---	NEMTF	Plans are prepared for lagoon
Honey Creek							
Boone WTP S-24	--	--	.064/NA	---	---	None	Backwash from iron and manganese filter.
Boone M-68	12,468	17,042	1.99/1.60	42/697	9/199	Trickling Filter Plant Wet Hauled to Land Fill	1958 rejuvenation of plant.
Sandler Built Homes Inc. I-40	--	--	---	---	---		Discharges to City STP
Des Moines River							
Camp Laurie S-21	--	--	NA/.010	---	---	---	Permit issued to conduct lagoon 1969.
Assemblies of God S-25	--	--	---	---	---	One Cell Lagoon Not Applicable	Total retention
Luther M-69	189	--	---	---	---	NEMTF	
Country Air MHP S-26	--	--	---	---	---	One Cell Lagoon Not Applicable	Total retention
Preston Branch							
Woodward State Inst. S-27	--	--	0.20/0.213	25/42	NA	Trickling Filter Wet Hauled to Farmland	Built in 1967
Big Creek							
Sheldahl M-221	285	500	NA/.0375	NA	NA	NEMTF	Will go to Slater

Table V-2
DISCHARGE INVENTORY

Discharger (Ref. No.)	1970 Pop.	Design P.E.	Effluent Flow (mgd) Average/Design	 BOD$_5$ (mg/l)/(lb/day)	 Ammonia-N (mg/l)/(lb/day)	Treatment Type Sludge Disposal	Comments
Little Creek							
Madrid M-70	2,448	3,000	0.198/0.305	35/58	13/21	Trickling Filter Wet Haul to Farmland	Built in 1967
Plains Poultry Farm Inc. I-41	--	--	0.011/.003	100/9	---	Five Cell Lagoon Not Applicable	Built in 1968
Big Creek							
Polk City M-71	700	800	0.070/0.080	40/33	13/7.6	Three Cell Lagoon Not Applicable	Constructed in 1963, additional cell added in 1974.
Des Moines River							
Jester Park S-28	--	--	NA	45/NA	---	One Cell Lagoon Not Applicable	
Rock Creek							
Ankeny Ind. M-154-2	--	--	.130/NA	100/108	---	Three Cell Lagoon Not Applicable	Treatment of John Deere industrial wastes
Des Moines River							
Saylorville Lake Recreation Area S-30	--	--	NA/.30	---	---	Lagoon Not Applicable	Irrigation if necessary
YMCA Boys Home of Iowa S-31	--	--	NA	43/--	---	One Cell Lagoon Not Applicable	
Camp Dodge S-33	--	--	0.060/NA	25/125	NA	Trickling Filter Dry Haul to State Land	To be abandoned. Discharge to Johnston STP when constructed
Beaver Creek							
Grand Junction M-117	967	1,000	0.04/0.072	35/12	1/0.3	Imhoff Tank Trickling Filter Open Drying Beds NEMTF	High sewer infiltration
Beaver M-72	113	--	---	---	---		

Table V-2
DISCHARGE INVENTORY

Discharger (Ref. No.)	1970 Pop.	Design P.E.	Effluent			Treatment Type Sludge Disposal	Comments
			Flow (mgd) Average/Design	BOD_5 (mg/l)/(lb/day)	Ammonia-N (mg/l)/(lb/day)		
East Beaver Creek							
Ogden M-73	1,661	1,900	0.342/0.246	35/100	12/34	Trickling Filter Dry Haul to Farmland	Constructed in 1958, high infiltration
Beaver Creek							
Berkley M-74	--	56	---	---	---	NEMTF	
Woodward M-75	1,010	965	0.084/0.0965	30/21	7/5	Two Cell Lagoon Not Applicable	8.52 acres
Bouton M-76	160	--	---	---	---	NEMTF	
Town & Country Inc. S-32	--	--	NA/0.0065	---	---	Single Cell Lagoon Not Applicable	.58 acres (M.H.P.)
Granger M-77	661	600	0.060/0.060	40/20	17/8.5	Two Cell Lagoon Not Applicable	Built in 1969, 6.0 acres
Grimes M-78	902	800	0.10/0.080	30/25	5/4.2	Trickling Filter None	New plant is under construction
Little Beaver Creek							
Beaver Valley Canning Co. I-43	--	--	0.063/NA	850/447	---	Lagoons, Spray Irrigation Not Applicable	To be connected to Grimes' new treatment plant when completed. Will continue to have cooling water discharge.
Beaver Creek							
Johnston M-224	2,236	--	---	---	---	NEMTF	Individual septic tanks
Urbandale Sa. Sew. Dist. M-79	NA	4,800	0.30/0.43	26/65	---	Trickling Filter Wet Haul to Farmland	Some wastes into Des Moines Sewer System
First Continental Co. Motel S-34	--	--	NA/0.025	---	---	Extended aeration, polish lagoon Not Available	To go to municipal as soon as possible

Table V-2
DISCHARGE INVENTORY

Discharger (Ref. No.)	1970 Pop.	Design P.E.	Effluent Flow (mgd) Average/Design	 BOD_5 (mg/1)/(lb/day)	 Ammonia-N (mg/1)/(lb/day)	Treatment Type Sludge Disposal	Comments
Des Moines River							
Saylor Creek							
Ankeny W. M-154-1	2,451	3,100	0.517/0.404	35/151	20/86	Trickling Filter Wet Haul to Farmland	
Mel Ray MHP S-29	--	--	NA	45/--	--	Single Cell Lagoon Not Applicable	
Walfley Creek							
Iowa Fund I-44	--	--	0.015/NA	80/10	---	One Cell Lagoon Not Applicable	
Mid Continent Industries I-45	--	--	0.050/NA	31/13	1/.4	Aerated Lagoons Not Applicable	
Firestone Tire & Rubber Co. I-46	--	--	1.270/NA	5/53	---	Solids Settling Ponds Not Applicable	Cooling and process water only
Ford Motor Co. I-47			CLOSED				
American Can Co. I-69	--	--	0.202/NA	---	---	None	Cooling water discharge only. Sanitary and Process waters to STP.
Regency Manor MHP S-35	--	--	NA	---	---	One Cell Lagoon Not Applicable	
North Raccoon River							
Marathon M-80	447	--	---	---	---	NEMTF	
Rembrandt M-81	250	300	0.015/0.030	30/4	16/2.3	Two Cell Lagoon Not Applicable	
Lateral 2							
Albert City M-82	683	1,155	0.080/0.048	25/17	7/4.7	Covered Trickling Filter Disposal to Land	Plant put into operation in 1951.

Table V-2
DISCHARGE INVENTORY

Discharger (Ref. No.)	1970 Pop.	Design P.E.	Effluent			Treatment Type Sludge Disposal	Comments
			Flow (mgd) Average/Design	BOD$_5$ (mg/l)/(lb/day)	Ammonia-N (mg/l)/(lb/day)		
North Raccoon River							
Poor Farm Creek							
Truesdale M-83	132	—	—	—	—	NEMTF	
Boyer Creek							
Storm Lake WTP S-36	—	—	.008/NA	—	—	Lagoon Land Disposal	Lime Sludge Discharge
IA Public Service I-48	—	—	0.1/NA	3/2.5	—	None	Cooling water discharge
Storm Lake M-84	6,876	46,000	1.516/2.40	40/506	13/164	Trickling Filter Open Drying Beds	New plant recommended
Storm Lake, Hygrade M-85	—	140,720	1.045/2.653	25/218	27/235	Anerobic/aerobic Lagoons Not Applicable	Controlled discharge, built 1966, D.T. = 163 days
Country Village MHP S-37	—	—	NA	—	—	One Cell Lagoon Not Applicable	Permit issued March 1972
Villas & Co., Inc. I-49	—	—	0.0986/NA	0	—	None	Defreeze water only. Sanitary and process wastes to Storm Lake STP.
Vista Products, Co. I-50	—	—	0.180/NA	28/42	2/3	None	Cooling water discharge only. Sanitary and process wastes to Storm Lake STP.
Lakeside M-86	353	—	—	—	—	—	Discharge to Storm Lake Hy-Grade

Table V-2
DISCHARGE INVENTORY

			Effluent				
Discharger (Ref. No.)	1970 Pop.	Design P.E.	Flow (mgd) Average/Design	BOD_5 (mg/l)/(lb/day)	Ammonia-N (mg/l)/(lb/day)	Treatment Type dge Disposal	Comments
North Raccoon River							
Nemaha M-88	117	—	—	—	—	NEMTF	City and school served by individual septic tanks.
Sac City WTP S-38	—	—	.0055/NA	—	—	None	Filter backwash - Lime Soda Ash Sludge
Sac City M-87	3,268	3,400	0.270/0.220	40/90	11/25	Trickling Filter Unknown	Preliminary plans for new facility submitted in 1973.
Sac County Road Gravel I-51	—	—	.050/NA	—	—	None	Road gravel quarry dewatering
Cedar Creek							
Laurens WTP S-39	—	—	NA	—	—	None	Filter backwash
Laurens M-89	1,742	2,430	0.160/0.132	40/53	13/17	Trickling Filter Open Drying Beds	Constructed in 1953
Mefferd Industries I-52	—	—	NA	—	—	None	Discharge is from chrome rinse tanks, 350 mg/l hexavalent chrome in the discharge.
Varina M-90	140	—	—	—	—	NEMTF	
Fonda WTP S-40	—	—	NA	—	—	None	Iron Filter backwash
Fonda M-96	980	1,387	0.088/0.111	54/40	7/5	Imoff tank, trickling filter Open Drying Beds	

Table V-2
DISCHARGE INVENTORY

Discharger (Ref. No.)	1970 Pop.	Design P.E.	Effluent Flow (mgd) Average/Design	Effluent BOD$_5$ (mg/l)/(lb/day)	Effluent Ammonia-N (mg/l)/(lb/day)	Treatment Type Sludge Disposal	Comments
Prairie Creek							
Newell WTP S-41	—	—	NA	—	—	None	Iron filter backwash
Newell M-92	701	1,440	0.087/0.110	35/25	7/5	Imhoff tank, trickling filter Open Drying Beds	Constructed in 1964
Buena Vista Co. Gravel Pit I-53	—	—	2.0	—	—	None	Discharge once in 3 to 5 years NE¼, Sec. 13, T90, R 35W.
Indian Creek							
Lake View M-93	1,249	3,220	0.218/0.280	25/45	NA	Two stage trickling filter Sludge Lagoon Drying Beds	Built in 1970
North Raccoon River							
Auburn M-94	329	—	—	—	—	NEMTF	Under consent order. Central collection system for septic tank effluent.
Camp Creek							
Jolley M-95	112	—	—	—	—	NEMTF	
Lytton WTP S-42	—	—	NA	—	—	—	To municipal lagoons
Lytton M-96	378	450	0.157/0.167	40/52	6/8	Aerated, 3 aerobic lagoons Not Applicable	Large dairy contributes to wasteload, 21.6 acres D.T. = 200 days.
Yetter M-97	47	—	—	—	—	NEMTF	

Table V-2
DISCHARGE INVENTORY

Discharger (Ref. No.)	1970 Pop.	Design P.E.	Effluent			Treatment Type Sludge Disposal	Comments
			Flow (mgd) Average/Design	BOD_5 (mg/l)/(lb/day)	Ammonia-N (mg/l)/(lb/day)		
Lake Creek							
Pomeroy M-98	765	900	0.073/0.062	35/21	3/1.8	Two Cell Lagoon Not Applicable	
Rockwell City M-99	2,396	4,300	0.264/0.288	30/66	16/35	Trickling Filter Open Drying Beds	High sewer infiltration
Rockwell City Women's Reformatory S-43	—	—	.007/NA	25/1.5	NA	One Cell Lagoon Not Applicable	.68 acres constructed 1961
Lake City N. M-100	1,100	1,800	0.090/0.151	30/23	NA	Trickling Filter Open Drying Beds	
Lake City S.W. M-101	810	NA	0.080/0.20	35/23	10/6.7	Imhoff tank, sand filter Open Drying Beds	New plant proposed
Twin Lakes Travel Park S-44	—	—	NA	—	—	—	
North Raccoon River							
Lanesboro M-102	203	—	—	—	—	NEMTF	
Cedar Creek							
Manson M-103	1,993	2,156	0.110/0.190	35/32	11/10	Two Cell Lagoon Not Applicable	20.30 acres constructed 1960
Knierim M-104	131	—	—	—	—	NEMTF	
Somers M-105	197	—	—	—	—	NEMTF	
Rinard M-106	88	40	0.003/0.004	25/.6	NA	Septic tank, sand filter Unknown	Only 30% of Rinard is on the City Septic tanks.
Lohrville M-107	553	1,200	0.053/0.069	30/13	10/4	Imhoff tank, trickling filter Disposal to Land	Built in 1958

Table V-2
DISCHARGE INVENTORY

Discharger (Ref. No.)	1970 Pop.	Design P.E.	Effluent			Treatment Type Sludge Disposal	Comments
			Flow (mgd) Average/Design	BOD_5 (mg/l)/(lb/day)	Ammonia-N (mg/l)/(lb/day)		
D.D. 171							
Crossroads Enterprise S-45	—	40	NA/.004	NA	NA	Septic Tank, sand filter Unknown	
Scranton M-108	751	1,270	0.065/0.127	35/19	18/10	Imhoff tank, trickling filter Open Drying Beds	
D.D. 132							
Jefferson WTP S-46	—	—	.100/NA	—	—	None	Backwash from lime softening, pH 8-11
Jefferson M-109	4,735	6,192	0.485/0.360	40/162	13.5/55	Trickling Filter Disposal to Land	Preliminary plans have been prepared for plant expansion, included nitrification.
Shriver-Van Hormer I-54	40	40	NA	—	—	Septic tank, tile field Unknown	Built in 1957
Hardin Creek							
Farnhamville WTP S-47	—	—	.0024/NA	—	—	None	(Sodium, Magnesium, Iron) backwash water
Farnhamville M-110	393	480	0.110/0.180	25/23	3/3	Two Cell Lagoon Not Applicable	3.8 acres
Churdan M-111	598	777	0.028/0.032	27/6	5/1.2	Two Cell Lagoon Not Applicable	5.78 acres, D.T. = 292 days
Butterick Creek							
Callendar M-112	421	600	0.020/0.050	—	—	Two Cell Lagoon Not Applicable	Lagoon expanded to P.E. of 600 due to be finished 1/31/75
Gowrie WTP S-48	—	—	NA	—	—	None	

Table V-2
DISCHARGE INVENTORY

Discharger (Ref. No.)	1970 Pop.	Design P.E.	Effluent			Treatment Type Sludge Disposal	Comments
			Flow (mgd) Average/Design	BOD_5 (mg/l)/(lb/day)	Ammonia-N (mg/l)/(lb/day)		
Gowrie M-113	1,225	2,050	0.188/0.185	26/41	5/8	Trickling Filter Wet Haul to Farm-land	Built 1965, high sewer infiltration
Harcourt M-114	305	—	—	—	—	NEMTF	Two cell lagoon in planning stage
Paton M-115	329	—	—	—	—	NEMTF	Two cell lagoon in planning stage
Dana M-116	118	—	—	—	—	NEMTF	In planning stage
North Raccoon River							
Jamaica M-118	271	—	—	—	—	NEMTF	
Snake Creek							
Rippey M-119	270	420	0.012/0.040	25/2.5	4/0.4	One Cell Lagoon Not Applicable	Constructed in 1969
North Raccoon River							
Dawson M-120	232	—	—	—	—	NEMTF	
Osmundson Mfg. Co. I-55	—	—	NA/.011	—	—	One Cell Lagoon Not Applicable	
Perry WTP S-49	—	—	NA	—	—	Two Cell Sludge Lagoon	Lime sludge and filter backwash
Perry M-121	6,906	12,600	1.052/1.545	35/307	8/70	Two stage trickling filter Dry Haul to Farm-land	

Table V-2
DISCHARGE INVENTORY

Discharger (Ref. No.)	1970 Pop.	Design P.E.	Effluent Flow (mgd) Average/Design	Effluent BOD$_5$ (mg/1)/(1b/day)	Effluent Ammonia-N (mg/1)/(1b/day)	Treatment Type Sludge Disposal	Comments
Oscar Mayer Co. I-56	—	—	0.67/1.0	75/419	70/391	Anaerobic aerobic lagoons Not Applicable	Lagoons do not have storage capabilities
IA Electric Light & Power Co. I-57	—	—	—	—	—	—	Boiler blow down, cooling water and water softening wash water discharges to Perry STP.
Minburn M-122	378	400	.032/0.048	25/6.7	4/1.1	Two Cell Lagoon Not Applicable	5.2 acre
Dallas County Home S-111	NA	110	—	—	—	None	One Cell Lagoon for 110 P.E. was proposed in 1972, area = .935 acres
Adel WTP S-51	—	—	NA	—	—	None	Iron and brine wastes.
Adel M-124	2,419	2,800	0.400/0.224	30/100	11/37	Trickling Filter Dry Haul to Farmland	Built in 1964 - Spiragester and trickling filter
South Raccoon River							
Guthrie Center M-125	1,834	4,392	0.186/0.286	35/54	13/20	Two Stage Trickling Filter Disposal to Land	Built in 1964
Brushy Creek							
Arcadia M-126	414	—	—	—	—	NEMTF	
Halbur M-127	235	—	—	—	—	NEMTF	
Dedham M-128	325	350	0.009/0.035	30/2.3	NA	Two Cell Lagoon Not Applicable	2.75 acres
South Raccoon River							
Long Branch							
Stuart M-129	1,354	1,500	.201/.150	25/42	13/22	Trickling Filter Dry Haul to Farmland	Built in 1967

Table V-2
DISCHARGE INVENTORY

Discharger (Ref. No.)	1970 Pop.	Design P.E.	Effluent			Treatment Type Sludge Disposal	Comments
			Flow (mgd) Average/Design	BOD_5 (mg/1)/(1b/day)	Ammonia-N (mg/1)/(1b/day)		
Diamondhead Lake S-52	NA	700	.025/.094	25/5	1/.2	One Cell Lagoon Not Applicable	
Middle Raccoon River							
Breda M-130	518	500	0.065/0.055	40/22	6/3	Imhoff, Trickling Filter Unknown	Permit issued 6/4/73 to construct waste stabilization lagoon, old plant to be demolished.
Carroll M-131	8,716	NA	0.805/1.200	27/181	10/67	Trickling Filter Disposal to Land	New plant under construction
Bernholt Brothers Frozen Food and Locker I-58	—	—	—	—	—	None	Discharge cooling water to storm sewer
Carroll Rendering Works I-59	—	—	NA/0.08	—	—	Anaerobic, aerobic Lagoon System Not Applicable	
Farner-Bocken Co. I-60	—	—	.003/NA	—	—	None	Cooling water discharge only. Sanitary and process waters to Carroll STP.
IA Public Service Co. Carroll Station I-61	—	—	—	—	—	Cooling Towers	Recycle Cooling water.
Storm Creek							
Lidderdale WTP S-53	—	—	NA	—	—	None	Iron in backwash water
Lidderdale M-132	173	360	.015/.036	NA	NA	Two Cell Lagoon Not Applicable	Completed in 1973
Middle Raccoon River							
Willey M-133	72	—	—	—	—	NEMTF	
Coon Rapids M-134	1,381	5,988	0.081/0.120	25/17	9/6	Trickling Filter Open Drying Beds	Constructed in 1942

Table V-2
DISCHARGE INVENTORY

Discharger (Ref. No.)	1970 Pop.	Design P.E.	Effluent			Treatment Type Sludge Disposal	Comments
			Flow (mgd) Average/Design	BOD$_5$ (mg/l)/(lb/day)	Ammonia-N (mg/l)/(lb/day)		
Storm Creek							
Glidden WTP S-55	—	—	.003/NA	—	—	None	Zeolite backwash
Willow Creek							
Glidden M-135	964	1,100	0.062/0.088	50/26	10/5	Trickling Filter Open Drying Beds	Constructed in 1952
Ralston M-136	129	—	—	—	—	NEMTF	
Bayard M-137	628	—	—	—	—	NEMTF	Permit issued 2/1/73 to construct treatment facility
Middle Raccoon River							
Springbrook State Park S-54	—	—	—	—	—	Lagoon Not Applicable	Total retention
Lake Panorama S-56	—	—	—	—	—	—	Discharge to municipal lagoon when constructed
Panora WTP S-57	—	—	.01/NA	—	—	None	Coagulation sludge
Panora M-138	986	1,260	0.150/0.125	35/44	NA	Two Cell Lagoon Not Applicable	
Linden M-139	278	—	—	—	—	NEMTF	
Mosquito Creek							
Bagley M-140	365	160	NA	NA	NA	Municipal septic tank primary only const. 1913 Unknown	Inadequate treatment facility
Yale M-141	301	—	—	—	—	NEMTF	

Table V-2
DISCHARGE INVENTORY

Discharger (Ref. No.)	1970 Pop.	Design P.E.	Effluent			Treatment Type Sludge Disposal	Comments
			Flow (mgd) Average/Design	BOD_5 (mg/1)/(1b/day)	Ammonia-N (mg/1)/(1b/day)		
South Raccoon River							
Redfield M-142	921	1,200	0.062/0.120	40/21	6/3.1	Two Cell Lagoon Not Applicable	Constructed in 1968
Northern IA Natural Gas Co., Redfield Compressor Station I-62	—	—	NA	—	—	Septic Tanks and tile field Unknown	Process wastes to I-63 Lagoon
Northern IA Natural Gas Co., Redfield Storage Area I-63	—	—	0.35/NA	—	—	Aerated Lagoon Not Applicable	Discharge only 28 days a year
Bear Creek							
Earlham M-143	974	841	0.236/0.093	30/59	4/8	Two Cell Lagoon Not Applicable	8.0 acres
Gendler Stone Products Co., Inc. I-64	—	—	0.024/NA	—	—	None	Quarry dewatering
Bugler Creek							
DeSoto M-144	572	467	.060/.047	31/16	NA	Two Cell Lagoon Not Applicable	Built in 1970
Raccoon River							
Van Meter M-145	464	445	0.033/0.045	50/14	10/2.8	Two Cell Lagoon Not Applicable	Built 1963, has seepage problems, operating only one cell
Prairie Village MHP S-58	—	—	NA	—	—	One Cell Lagoon Not Applicable	Lagoon is over sized, no discharge.
Iowa Hwy Comm. Rest Area S-59	—	—	.078/NA	NA	NA	One Cell Lagoon Not Applicable	

Table V-2
DISCHARGE INVENTORY

Discharger (Ref. No.)	1970 Pop.	Design P.E.	Effluent Flow (mgd) Average/Design	Effluent BOD_5 (mg/l)/(lb/day)	Effluent Ammonia-N (mg/l)/(lb/day)	Treatment Type Sludge Disposal	Comments
Southwest Polk Water Co. S-60	—	—	.006/NA	—	—	None	Iron in backwash water
Sugar Creek							
Waukee M-146	1,577	3,000	NA/.300	25/NA	NA	Aerated, aerobic Lagoon Not Applicable	8.2 acres, aerators added in 1974.
Fox Creek Water Co. S-61	—	—	NA	—	—	None	Iron in backwash water
Jordan Creek							
Walter T. Giles High Rise Motel S-62	—	—	NA	—	—	Two Cell Lagoon Not Applicable	One cell aerated, to discharge to municipal in the future.
Walnut Creek							
Dallas Center WTP S-50	—	—	.009/NA	—	—	None	Softener, brime, iron constituents.
Dallas Center M-123	1,128	900	0.188/0.066	30/47	2/3.1	Imhoff tank, Trickling Filter Wet Haul to Farmland	
Hinkson MHP S-63	—	—	.005/NA	—	—	Single Cell Lagoon Not Applicable	
Des Moines Golf & Country Club S-64	—	—	.05/NA	25/10	—	Aerated Lagoon Not Applicable	
National Crossroads Campground S-65	60 spaces		NA	—	—	One Cell Lagoon Not Applicable	NW¼, NE¼, S6, T78, R25W
Skelly Oil Co. I-65	—	—	.008/NA	25/1.7	—	Aerated Lagoon Not Applicable	Crossroads USA, Urbandale
American Oil Co. I-66	—	—	NA	—	—	Oil Seperator	Runoff to stream & possible oil product spillage

Table V-2
DISCHARGE INVENTORY

			Effluent				
Discharger (Ref. No.)	1970 Pop.	Design P.E.	Flow (mgd) Average/Design	BOD$_5$ (mg/l)/(lb/day)	Ammonia-N (mg/l)/(lb/day)	Treatment Type / Sludge Disposal	Comments
Roadrunner Campground & MHP S-66	41 spaces		NA	—	—	One Cell Lagoon Not Applicable	
Champlain Truck Stop I-67	—	—	—	—	—	One Cell Lagoon Not Applicable	Total retention
Raccoon River							
Meridith Corp. I-68	—	—	0.85/NA	—	—	None	Cooling water recycled to Des Moines Water Works
KOA Campgrounds S-67	16 spaces		—	—	—	—	Permit issued 8/25/69 for lagoon.
Des Moines Water Works S-68	—	—	.3/NA	—	—	Total retention lagoon	Lime-soda ash sludge, backwash.
Des Moines River							
Clive M-147	3,005	—	—	—	—	—	To Des Moines STP
West Des Moines M-148	16,441	—	—	—	—	—	To Des Moines STP
Windsor Heights M-149	6,303	—	—	—	—	—	To Des Moines STP
Dean's Lake							
Armstrong Rubber Co. I-70	—	—	2.85/NA	8/190	—	None	Cooling water
Chicago, Rock Island and Pacific R.R. I-71	—	—	0.005/NA	—	—	None	Water from oil traps
Frye Copy Systems I-72	—	—	0.72/NA	—	—	—	Cooling water to city storm sewer.
Lennox Industries I-73	—	—	0.038/NA	—	—	—	Cooling water to city storm sewer.

Table V-2
DISCHARGE INVENTORY

Discharger (Ref. No.)	1970 Pop.	Design P.E.	Flow (mgd) Average/Design	Effluent BOD$_5$ (mg/l)/(lb/day)	Ammonia-N (mg/l)/(lb/day)	Treatment Type Sludge Disposal	Comments
Des Moines River							
Des Moines (#1) M-150	201,404	540,000	38.9/35.0	30/9,733	11/3,569	Trickling Filter Wet Haul to Land Fill	
Yeader Creek							
Des Moines Area C Sanitary Lagoon M-222	NA	3,050	NA/.3	----	----	One Cell Lagoon Not Applicable	Under Construction
Des Moines River							
IA Power & Light I-74	----	----	150/NA	----	----	None	Three discharges of cooling water.
Four Mile Creek							
Slater M-152	1,094	350	0.090/0.158	60/45	14/11	Two Cell Lagoon Not Applicable	16.81 acres
Allemen M-227	183	---	0.01/---	----	----	NEMTF	Individual Septic Tanks Discharge to stream
IA Highway Comm. Rest Stop S-107	---	---	NA/0.005	NA	NA	One Cell Lagoon Not Applicable	
Ankeny E. M-153	6,700	4,200	9.910/0.285	30/228	8/61	Trickling Filter Dry Haul to Farmland	New plant is under construction to handle hydraulic & organic overloading.
Oakwood Heights MHP S-69	---	---	NA	---	---	One Cell Lagoon Not Applicable	164 spaces, total retention
Greenwood Acres WTP S-70	---	---	0.001/NA	---	---	None	Iron backwash-1,000 gal/week
Sunny Brook MHP S-71	---	---	.025/NA	23/5	8	One Cell Lagoon Not Applicable	
Altoona M-155	2,883	3,600	0.534/1.5	30/134	8/36	Trickling Filter disinfection Wet Haul to Farmland	Built in 1969

Table V-2
DISCHARGE INVENTORY

Discharger (Ref. No.)	1970 Pop.	Design P.E.	Effluent			Treatment Type Sludge Disposal	Comments
			Flow (mgd) Average/Design	BOD$_5$ (mg/1)/(1b/day)	Ammonia-N (mg/1)/(1b/day)		
Country Living MHP S-72	---	---	NA	---	---	One Cell Lagoon Not Applicable	
Des Moines River							
S.E. Polk Comm. Sch. S-73	---	---	0.013/0.026	25/2.7	---	Extended aeration Wet Haul to Farmland	Built in 1963
Pleasant Hill M-156	1,536	3,664	0.110/0.360	36/33	9/8	Trickling Filter Disinfection Compost Sludge	
North River							
Menlo M-157	391	--	---	---	---	NEMTF	
North Branch							
Dexter M-158	652	750	NA/.075	44/28	11/7	Two Cell Lagoon Not Applicable	7.5 acres
Cedar Creek							
Winterset WTP S-74	---	---	0.720/NA	---	---	None	Filter backwash & sludge
Madison County Home S-75	---	---	NA/0.005	NA	NA	Aerated lagoon, polishing pond Not Applicable	
E.I. Sargent I-75	---	---	NA	---	---	Settling ponds	Quarry dewatering, Sec. 27, T 76 R 27W.
Schildberg I-76	---	---	NA	---	---	None	Quarry dewatering, Sec. 22, T 76 R 27W
North River							
Middle Creek							
Cumming M-162	189	---	---	---	---	NEMTF	

Table V-2
DISCHARGE INVENTORY

Discharger (Ref. No.)	1970 Pop.	Design P.E.	Effluent Flow (mgd) Average/Design	Effluent BOD$_5$ (mg/l)/(lb/day)	Effluent Ammonia-N (mg/l)/(lb/day)	Treatment Type Sludge Disposal	Comments
Windmill Creek							
IA Metro Sewer M-160	NA	1,500	.100/.120	37/31	8/7	One Cell Lagoon Not Applicable	15 acres
Norwalk M-159	1,745	—	—	—	—	—	To Iowa Metro Sewer
Des Moines Highland Hills M-151	4,600	6,100	.525/.432	40/175	16/70	Trickling Filter Wet Haul to Farmland	
Des Moines Area B M-223	NA	3,050	NA/.300	—	—	One Cell Lagoon Not Applicable	Under Construction
Middle Creek							
Des Moines Water Dev. Co. S-76	—	—	.015/NA	—	—	None	Iron Filter backwash
Greenfield Plaza M-161	NA	2,000	.350/.200	NA	NA	One Cell Lagoon Not Applicable	15.9 acres
North River							
Carlisle M-163	2,246	4,000	.104/.295	25/22	1/.9	Four Cell Lagoon Not Applicable	36.1 acres
Carlisle WTP S-77	—	—	.065/NA	—	—	None	Filter backwash
Carlisle Sand & Gravel I-77	—	—	NA	—	—	None	Wash water, Sec 5 & 6, T 76 R 22W.
Middle River							
South Fork							
Adair M-164	750	1,000	.057/.100	45/19	8/3	Imhoff Tank, Trickling Filter Open Sludge Pits	Built in 1962

Table V-2
DISCHARGE INVENTORY

Discharger (Ref. No.)	1970 Pop.	Design P.E.	Effluent Flow (mgd) Average/Design	Effluent BOD$_5$ (mg/l)/(lb/day)	Effluent Ammonia-N (mg/l)/(lb/day)	Treatment Type Sludge Disposal	Comments
Middle River							
Casey M-165	561	700	.022/.070	25/5	3/.6	Contact stabilization & polishing pond Unknown	
Menlo WTP S-79	—	—	.027/NA	—	—	None	Filter backwash
IA Highway Comm. Rest Area S-78-A&B	—	—	.005	NA	NA	One Cell Lagoon Not Applicable	
Schildberg Const. Co. I-79	—	—	NA	—	—	None	Quarry dewatering NW¼, S 17, T 77, R 31W.
Schildberg Const. Co. I-80	—	—	NA	—	—	None	Dewatering quarry SE¼, S 17, T 77, R 31W.
Nickerson Farms I-78	—	—	—	—	—	One Cell Lagoon Not Applicable	Total retention
Winterset M-166	3,685	5,300	.320/.500	28/75	6/16	Trickling Filter Wet Haul to Farmland	Built in 1969
Patterson M-167	120	—	—	—	—	NEMTF	
Bevington M-168	54	—	—	—	—	NEMTF	
Martensdale M-169	306	400	NA/.04	26/NA	5/NA	Two Cell Lagoon Not Applicable	3.44 acres
Middle River							
Clanton Creek							
North Fork							
E.I. Sargent I-81	—	—	NA	—	—	None	Quarry dewatering NE¼ Sec. 10 T 74, R 27W.

Table V-2
DISCHARGE INVENTORY

Discharger (Ref. No.)	1970 Pop.	Design P.E.	Effluent			Treatment Type Sludge Disposal	Comments
			Flow (mgd) Average/Design	BOD_5 (mg/l)/(lb/day)	Ammonia-N (mg/l)/(lb/day)		
Middle River							
Clanton Creek							
East Peru M-170	184	--	---	---	---	NEMTF	
Hay Branch							
Truro M-171	359	450	.045/.040	25/9	NA	Two Cell Lagoon Not Applicable	3.5 acres
Unnamed Tributary							
St. Charles M-172	443	--	---	---	---	NEMTF	
Middle River							
Spring Hill M-173	131	--	---	---	---	NEMTF	
Unnamed Tributary							
Indianola N. M-174	4,976	5,500	.651/.463	25/136	3/16	Trickling Filter Wet Haul to Farmland	North plant built in 1953
Butcher Creek							
Hartford MHP S-80	--	--	NA	---	---	One Cell Lagoon Not Applicable	
Hartford M-226	582	--	---	---	---	NEMTF	Individual Septic Tanks
Des Moines River							
Mud Creek							
Bondurant M-175	462	486	.047/.049	48/19	12/4.7	Two Cell Lagoon Not Applicable	4.16 acres, constructed in 1960
S. E. Polk High School S-81	---	---	.020/NA	25/4	1/.2	Extended aeration Wet Haul to Farmland	

Table V-2
DISCHARGE INVENTORY

Discharger (Ref. No.)	1970 Pop.	Design P.E.	Effluent: Flow (mgd) Average/Design	Effluent: BOD$_5$ (mg/l)/(lb/day)	Effluent: Ammonia-N (mg/l)/(lb/day)	Treatment Type Sludge Disposal	Comments
Runnells M-176	354	—	—	—	—	NEMTF	To build extended aeration activated sludge facility
South River							
St. Mary's M-177	105	—	—	—	—	NEMTF	
Squaw Creek							
South Squaw Creek							
Concrete Materials I-82	—	—	NA	—	—	None	Quarry operations 53/4, Sec. 12, T 72, R26W
E.I. Sargent I-83	—	—	NA	—	—	None	Quarry operations Sec. 1 T 72, R 26W.
Squaw Creek							
IA Promotional Man. S-82	—	—	NA	—	—	One Cell Lagoon Not Applicable	System in poor condition
MBZ Mobil Home Park S-83	—	—	NA	—	—	One Cell Lagoon Not Applicable	
New Virgina S.D. M-178	450	462	.028/.028	25/5.8	—	Two Cell Lagoon Not Applicable	4 acres
Stuckeys I-84	—	—	NA/.003	—	—	Aeration Unit & soil absorption pit Unknown	Package aeration unit (Oxigest)
South River							
Indianola S. M-179	4,000	4,000	0.45/.40	25/93.8	3/11.3	Contact stabilization and polishing pond Wet Haul to Farmland	South Plant

Table V-2
DISCHARGE INVENTORY

Discharger (Ref. No.)	1970 Pop.	Design P.E.	Effluent Flow (mgd) Average/Design	Effluent BOD$_5$ (mg/l)/(lb/day)	Effluent Ammonia-N (mg/l)/(lb/day)	Treatment Type Sludge Disposal	Comments
South River							
Otter Creek							
S.E. Warren Comm. School S-109	NA	—	NA/.01	NA	NA	Three Cell Lagoon Not Applicable	Construction permit for three cell lagoon was issued 5/1/74.
Milo M-180	561	480	NA/.048	54/NA	3/NA	Two Cell Lagoon Not Applicable	Construction 1968 4 acres
South River							
Ackworth M-181	111	--	—	—	—	NEMTF	
Sandyville M-182	89	—	—	—	—	NEMTF	
Coal Creek							
Pleasantville M-183	1,297	1,300	.047/.120	33/13	7/2.7	Three Cell Lagoon Not Applicable	10.7 acres
Des Moines River							
Camp Creek							
Mitchellville M-184	1,341	1,500	.085/.150	35/25	6/4.3	Imhoff Tank & Trickling Filter Wet Haul to Farmland or Land Fill	Built in 1954
Ditch							
IA Highway Comm. Rest Stop S-84	--	—	NA	—	—	One Cell Lagoon Not Applicable	Seasonal discharge
Camp Creek							
Thomas Mitchell Park S-85	--	—	NA	—	—	One Cell Lagoon Not Applicable	Seasonal discharge

Table V-2
DISCHARGE INVENTORY

Discharger (Ref. No.)	1970 Pop.	Design P.E.	Effluent			Treatment Type Sludge Disposal	Comments
			Flow (mgd) Average/Design	BOD$_5$ (mg/l)/(lb/day)	Ammonia-N (mg/l)/(lb/day)		
Des Moines River							
Calhoun Creek							
Prairie City M-185	1,141	2,400	.370/.208	25/77	NA	Two Cell Lagoon Not Applicable	3.2 acres
Des Moines River							
Brush Creek							
Monroe M-225	1,389	408	.040/.031	40/13	NA	One Cell Lagoon Not Applicable	4.21 acres
Des Moines River							
Elk Rock State Park S-108	NA	—	NA	NA	NA	Multi Complex. Total Retention Lagoon Not Applicable	Four separate lagoon facilities to serve State Park.
White Breast							
IA Highway Comm. S-86	—	—	NA/.004	—	—	One Cell Lagoon Not Applicable	
Osceola M-186-1	3,124*	18,000	.573/.550	51/243	10/48	Two Cell Lagoon One Small aerated Lagoon Not Applicable	S. plant 20 acres, plant overloaded by industrial wastes, discharge occurs after 5 working days at flow of 1.925 MGD for 2 days.
Osceola M-186-2	3,124*	3,000	.19/.225	46/73	23/36	Trickling Filter Wet Haul to Farmland	E. Plant
Champlain Pet. Co. I-85	—	—	—	—	—	Lagoon Not Applicable	Total retention

*City's Total Population

Table V-2
DISCHARGE INVENTORY

Discharger (Ref. No.)	1970 Pop.	Design P.E.	Flow (mgd) Average/Design	Effluent BOD$_5$ (mg/l)/(lb/day)	Effluent Ammonia-N (mg/l)/(lb/day)	Treatment Type Sludge Disposal	Comments
R & R Campground S-87	—	—	NA	—	—	One Cell Lagoon Not Applicable	
Woodburn M-187	186	—	—	—	—	NEMTF	
Lucas M-188	247	—	—	—	—	NEMTF	
Williamson M-189	216	—	—	—	—	NEMTF	
Mill Branch Creek							
Lacona Oil Co. I-86	—	—	NA	—	—	None	Car wash - oil and grease
Lacona M-190	424	540	.034/.081	25/7	2/.6	Two Cell Lagoon Not Applicable	7.61 acres - D.T. = 82 days, const. 1964
White Breast							
Winn Branch							
C.D. Hess & Son Rock I-88	—	—	NA	—	—	None	Quarry dewatering
Competine Creek							
Knoxville STP M-191	7,755	12,500	.606/1.25	25/126	10/50	Trickling Filter & Disinfection Wet Haul to Farmland	
Knoxville WTP S-88	—	—	NA	—	—	None	Filter backwash water
Red Rock Lake View Subdivision S-89	—	—	NA	—	—	One Cell Lagoon Not Applicable	81 Lots

Table V-2
DISCHARGE INVENTORY

Discharger (Ref. No.)	1970 Pop.	Design P.E.	Effluent			Treatment Type Sludge Disposal	Comments
			Flow (mgd) Average/Design	BOD_5 (mg/l)/(lb/day)	Ammonia-N (mg/l)/(lb/day)		
Unnamed Tributary							
Knoxville V.A. Hospital S-90	—	—	.186/.250	—	—	Trickling Filter & disinfection Dry Haul to Farmland	Plant to be abandoned, sewage to go to municipal plant.
Marion County Home S-91	—	—	—	—	—	Lagoon Not Applicable	Total retention lagoon
Sents Creek							
Pella STP M-192	NA	—	.054/.043	31/14	3/1.35	Imhoff tank & Trickling Filter Dry Haul to Farmland	South West Plant Const. 1949.
Pella WTP S-92	—	—	0.028/NA	—	—	None	Filter backwash water
Vermeer Mfg. Co. I-90	—	—	NA	—	—	Septic tank to holding pond Unknown	Lagoon planned for future
English Creek							
Tracy Creek							
Melcher M-193	913	1,259	.10/.1259	33/28	5/4	Two Cell Lagoon Not Applicable	10.7 acres
Dallas M-194	438	—	—	—	—	—	To Melcher Lagoon
English Creek							
Harvey M-195	217	—	—	—	—	NEMTF	
Kaser Const. Co. I-91	—	—	NA	—	—	None	Quarry dewatering, discolored discharge, SW¼ Sec. 4-T 75 - R 18W.
Kaser Const. Co. I-92	—	—	NA	—	—	None	Quarry dewatering Sec. 8-T 15 - R 18W.

Table V-2
DISCHARGE INVENTORY

Discharger (Ref. No.)	1970 Pop.	Design P.E.	Effluent			Treatment Type Sludge Disposal	Comments
			Flow (mgd) Average/Design	BOD_5 (mg/l)/(lb/day)	Ammonia-N (mg/l)/(lb/day)		
Des Moines River							
Pella Limestone Co. I-93	—	—	NA	—	—	Holding Pond	Pond is adequate for solids settling NE¼ Sec. 18 - T 15-R 17W.
Cedar Creek							
Melrose M-196	192	—	—	—	—	NEMTF	
Marysville M-197	91	—	—	—	—	NEMTF	
Walnut Creek							
Pershing Utilities Corp. I-94	—	—	.0001/NA	—	—	None	Iron Filter backwash
N. Coal Creek							
S. Coal Creek							
Lovilia M-198	640	656	.012/.065	32/3	4/.4	Two Cell Lagoon Not Applicable	5.5 acres
Lovilia WTP S-93	—	—	.006/NA	—	—	None	Filter backwash water
Hamilton M-199	186	—	—	—	—	NEMTF	
Twin Cedar Comm. School S-110	400	100	NA/.013	NA	NA	One Cell Lagoon	Triangular shaped Lagoon
Bussey M-200	498	200	NA/.02	52/22	NA	One Cell Lagoon Not Applicable	
Bluff Creek							
Monroe Co. Park S-94	—	—	NA/.0002	NA	NA	One Cell Lagoon Not Applicable	

Table V-2
DISCHARGE INVENTORY

Discharger (Ref. No.)	1970 Pop.	Design P.E.	Flow (mgd) Average/Design	Effluent		Treatment Type / Sludge Disposal	Comments
				BOD_5 (mg/l)/(lb/day)	Ammonia-N (mg/l)/(lb/day)		
Des Moines River							
Martin Marietta Corp. I-95 (Eddyville)	—	—	NA	—	—	None	Quarry Dewatering Sec. 36 - T 74 - R 16.
Grays Creek							
Kasser Const. Co. I-96	—	—	.005/NA	—	—	Settling pond	Quarry Dewatering
Des Moines River							
Concrete Mat. Div. I-97	—	—	NA	—	—	Holding ponds	Ponds are adequate S½, Sec. 36, T 74, R 16W.
Muchakinock Creek							
Leighton M-201	140	—	—	—	—	NEMTF	
Beacon M-202	431	718	.023/.072	33/6	12/2.3	Two Cell Lagoon / Not Applicable	Built 1967, 4.23 acres
Little Muchakinock Creek							
Oskaloosa M-203	240	1,560	.051/.05	25/11	6/2.6	Aerated Lagoons / Not Applicable	2 acres D.T. = 15.8 days S. Plant
Oskaloosa M-204	6,000	12,000	.410/.810	50/171	16/55	Activated sludge, disinfection / Dry Haul to Land Fill	S.W. Plant
Hacherts Mobile Home S-95	—	—	—	—	—	One Cell Lagoon / Not Applicable	Total Retention
Mahaska Bottling I-98	—	—	NA	—	—	No Treatment	Required to go to municipal STP

Table V-2
DISCHARGE INVENTORY

Discharger (Ref. No.)	1970 Pop.	Design P.E.	Effluent			Treatment Type Sludge Disposal	Comments
			Flow (mgd) Average/Design	BOD_5 (mg/l)/(lb/day)	Ammonia-N (mg/l)/(lb/day)		
Kaser Const. Co. I-99	—	—	NA	—	—	None	Has no Natural Resources Water Permit NW¼, Sec. 12, T 74, R 16W.
Clow Corp. I-100	—	—	0.013/NA	—	—	None	Cooling water discharge
Miller Creek							
Albia M-205	NA	1,307	.114/.137	93/88	14/13	Imhoff tank, trickling Filter Dry Haul Farmland	Built 1952, S.W. plant, total 1970 Albia population is 4,151.
Albia M-206	NA	6,500	.273/.634	53/121	20/46	Trickling Filter Dry Haul to Farmland	Built 1965, N. plant.
Chamberlain Mfg. I-101	—	—	NA	—	—	None	
IA Southern Utilities I-102	—	—	1.3/.39	—	—	Septic tank, ash basin Unknown	Cooling tower and septic tank discharge to ash basin.
Des Moines River							
Eddyville M-207	970	1,100	.138/.138	59/64	8/9	Two Cell Lagoon Not Applicable	8.25 acres built 1968
Unnamed Tributary							
Kirkville M-208	222	—	—	—	—	NEMTF	
South Avery							
Chillicothe M-209	126	—	—	—	—	NEMTF	
Des Moines River							
Material Service I-103	—	—	NA	—	—	None	Quarries operation & dewatering NE¼, Sec. 23, T 72, R 14W.

Table V-2
DISCHARGE INVENTORY

			Effluent				
Discharger (Ref. No.)	1970 Pop.	Design P.E.	Flow (mgd) Average/Design	BOD_5 (mg/1)/(lb/day)	Ammonia-N (mg/1)/(lb/day)	Treatment Type Sludge Disposal	Comments
Bear Creek							
Chicago, Milwaukee, St. Paul, & Pacific R.R. I-104	—	—	.002/NA	—	—	Oil separation tanks	
Woodland Hills MHP S-96	—	—	NA	—	—	One Cell Lagoon	
Des Moines River							
Ottumwa WTP S-97	—	—	0.13/NA	—	—	None	Filter backwash water, lime sludge.
Ottumwa STP M-210	29,610	NA	2.18/5.5	23/418	4/127	Trickling Filter, disinfection Disposal to Land	Plant modification just completed.
Rabbit Run MHP S-98	—	—	NA/0.013	NA	NA	Extended Aeration unit Unknown	Package extended aeration unit.
George A. Hormel & Co. I-105	—	—	——— TEMPORARILY CLOSED ———			Oxidation Ditch Disposal to Land	The Morrell Pack facilities will be used by Hormel.
Martin Marietta Corp. I-106	—	—	NA	—	—	None	Sand plant
Des Moines River							
Chippewa Creek							
Eldon WTP S-99	—	—	.007/NA	—	—	None	
Des Moines River							
Eldon M-211	1,319	1,300	NA/.130	NA	NA	Two Cell Lagoon Not Applicable	16 acres

Table V-2
DISCHARGE INVENTORY

Discharger (Ref. No.)	1970 Pop.	Design P.E.	Effluent			Treatment Type Sludge Disposal	Comments
			Flow (mgd) Average/Design	BOD$_5$ (mg/l)/(lb/day)	Ammonia-N (mg/l)/(lb/day)		
Soap Creek							
Moravia M-212	699	666	.053/.054	30/13	—	Two Cell Lagoon Not Applicable	Area unknown
S. Soap Creek							
Sundown Lake Devel. S-100	—	—	NA/.049	—	—	One Cell Lagoon Not Applicable	
Little Soap							
Blakesburg M-213	403	—	—	—	—	NEMTF	Three cell lagoon planned.
Soap Creek							
Floris M-214	145	—	—	—	—	NEMTF	
Stump Creek							
Kaser Const. Co. I-107	—	—	NA	—	—	None	Quarry dewatering NW¼, Sec. 16, T 70, R 11W.
Des Moines River							
Douds Stone, Inc. (Gardner Quarry) I-113	—	—	.100/NA	—	—	None	Quarry dewatering Sec. 16 - 17, T 70, R 11W.
Unnamed Tributary							
Kaser Const. Co. I-108	—	—	NA	—	—	None	Quarry dewatering Sec. 19-20, T 70, R 11W.
Des Moines River							
Douds Stone, Inc. (Nedrow Quarry) I-114	—	—	.100/NA	—	—	None	Quarry dewatering Sec 35, T 70, R 11W.
Douds Mine I-109	—	—	.180/NA	—	—	Settling Pond	Quarry dewatering only Sec. 25, T 70, R 11W.

Table V-2
DISCHARGE INVENTORY

Discharger (Ref. No.)	1970 Pop.	Design P.E.	Effluent Flow (mgd) Average/Design	Effluent BOD$_5$ (mg/l)/(lb/day)	Effluent Ammonia-N (mg/l)/(lb/day)	Treatment Type Sludge Disposal	Comments
Lick Creek							
Libertyville M-215	329	—	—	—	—	NEMTF	
Chequest							
Burchett Supper Club I-110	—	—	NA	—	—	One Cell Lagoon Not Applicable	
Douds Stone, Inc. (Lewis Quarry) I-111	—	—	.100/NA	—	—	None	Quarry dewatering Sec. 16, T 70, R 12W.
Des Moines River							
Unnamed Creek							
Keosauqua WTP S-101	—	—	NA	—	—	None	
Des Moines River							
Keosauqua M-216	1,018	1,270	.079/.127	36/24	2/1	Two Cell Lagoon Not Applicable	10.6 acres, placed into operation in 1968.
Bonaparte M-217	547	—	—	—	—	NEMTF	Waste stabilization 3 cell lagoon is planned.
Big Indian Creek							
Triangle Quarries I-112	—	—	NA	—	—	None	Quarry dewatering
Des Moines River							
Farmington M-218	800	—	—	—	—	NEMTF	
Harmony Comm. H.S. S-102	—	—	NA/.010	—	—	Single Cell Lagoon Not Applicable	

Table V-2
DISCHARGE INVENTORY

Discharger (Ref. No.)	1970 Pop.	Design P.E.	Effluent Flow (mgd) Average/Design	Effluent BOD$_5$ (mg/l)/(lb/day)	Effluent Ammonia-N (mg/l)/(lb/day)	Treatment Type / Sludge Disposal	Comments
Sugar Creek							
Donnellson M-219	798	960	.078/.072	26/17	13/8	Imhoff Tank, Trickling Filter Open Drying Beds	Built in 1936
Sugar Valley Campground S-103	—	—	NA	—	—	One Cell Lagoon Not Applicable	
Main Creek							
Argyle School S-104	—	—	NA	—	—	Septic Tank Unknown	Effluent discharge into farm field
Central High School S-105	—	—	NA	—	—	One Cell Lagoon Not Applicable	

** Abbreviations used include:

Ammonia-N = Ammonia-Nitrogen
BOD$_5$ = Five Day Biochemical Oxygen Demand
cfs = Cubic feet per second
COD = Chemical Oxygen Demand
D.D. = Drainage Ditch
D.T. = Detention Time
gal. = gallons
lbs. = pounds
mgd = million gallons per day
mg/l = milligrams per liter
MHP = Mobile Home Park
NA = Not Available
NEMTF = No Existing Municipal Treatment Facility
P.E. = Population Equivalent
Pop. = Population
R. = Range
Ref. No. = Reference Number
S.D. = Sanitary District
Sec. = Section
S.S. = Suspended Solids
STP = Sewage Treatment Plant
T = Township
WTP = Water Treatment Plant

TABLE V-3

DES MOINES RIVER BASIN
POINT SOURCE
WASTEWATER DISCHARGE SUMMARY

	Municipal	Semipublic	Industrial
Blue Earth River			
Flow (mgd)	0.10	-	-
%Total flow	100	-	-
BOD_5 (lbs/day)	29	-	-
%Total BOD_5	100	-	-
Ammonia-N (lbs/day)	7	-	-
%Total ammonia-N	100	-	-
West Fork Des Moines River			
Flow (mgd)	3.224	0.01	7.460
%Total flow	30	1	69
BOD_5 (lbs/day)	2555	-	463
%Total BOD_5	85		15
Ammonia-N (lbs/day)	641	-	-
%Total Ammonia-N	100		
East Fork Des Moines River			
Flow (mgd)	1.388	0.023	0.37
%Total flow	78	1	21
BOD_5 (lbs/day)	555	-	-
%Total BOD_5	100		
Ammonia-N (lbs/day)	88	-	-
%Total Ammonia-N	100		
Boone River			
Flow (mgd)	2.986	0.280	11.748
%Total flow	20	2	78
BOD_5 (lbs/day)	823	-	-
%Total BOD_5	100		
Ammonia-N (lbs/day)	349	-	-
%Total Ammonia-N	100		
Upper Main Stem Des Moines River			
Flow (mgd)	7.694	0.557	3.96
%Total flow	63	5	32
BOD_5 (lbs/day)	2490	167	789
%Total BOD_5	72	5	23
Ammonia-N (lbs/day)	839	-	-
%Total Ammonia-N	100		

TABLE V-3 (CONTINUED)

	Municipal	Semipublic	Industrial
Raccoon River			
Flow (mgd)	9.054	0.302	5.689
%Total flow	60	2	38
BOD$_5$ (lbs/day)	2345	429	436
%Total BOD$_5$	84	15	392
Ammonia-N (lbs/day)	815	1	-
%Total Ammonia-N	99.9	0.1	
Middle River			
Flow (mgd)	1.135	0.281	-
%Total flow	80	20	-
BOD$_5$ (lbs/day)	244	-	-
%Total BOD$_5$	100		
Ammonia-N (lbs/day)	36	-	-
%Total Ammonia-N	100		
Lower Main Stem Des Moines River			
Flow (mgd)	48.288	1.890	151.627
%Total flow	24	0.1	76
BOD$_5$ (lbs/day)	12,209	9	0
%Total BOD$_5$	99.9	1	0
Ammonia-N (lbs/day)	4,320	1	3
%Total Ammonia-N	99.8	0.1	0.2

TABLE V-4

MUNICIPAL WASTEWATER TREATMENT FACILITY PROCESS SUMMARY BY SUBBASIN

Type of Facility	No. of Facilities	Population Served
Blue Earth River		
Two Cell Lagoon	1	1,118
Total		1,118
No Treatment	3	949
West Fork Des Moines River		
Single Cell Lagoon	2	1,674
Three Cell Lagoon	1	384
Trickling Filter	3	16,878
Imhoff-Trickling Filter	1	865
Total		19,801
No Treatment	9	1,429
East Fork Des Moines River		
Single Cell Lagoon	6	3,834
Imhoff Tank	1	1,103
Trickling Filter	4	8,035
Total		12,972
No Treatment	5	830
Boone River		
Single Cell Lagoon	2	1,147
Two Cell Lagoon	2	1,215
Three Cell Lagoon	1	380
Trickling Filter	4	17,518
Total		20,260
No Treatment	3	982
Upper Main Stem Des Moines River*		
Single Cell Lagoon	5	2,146
Two Cell Lagoon	7	3,732
Trickling Filter	8	54,440
Activated Sludge	1	710
Total		61,028
No Treatment	9	4,206

*Main Stem of Des Moines River above Raccoon River Confluence

TABLE V-4 (CONTINUED)

Type of Facility	No. of Facilities	Population Served
Raccoon River		
Single Cell Lagoon	1	270
Two Cell Lagoon	16	12,858
Three Cell Lagoon	1	378
Imhoff Tank	1	1,225
Septic Tank	2	453
Trickling Filter	16	46,843
Imhoff-Trickling Filter	7	6,438
Total		68,470
No Treatment	20	5,172
Middle River		
Two Cell Lagoon	2	665
Three Cell Lagoon	1	561
Trickling Filter	2	8,661
Imhoff-Trickling Filter	1	750
Total		10,637
No Treatment	5	932
Lower Main Stem Des Moines River*		
Single Cell Lagoon	2	3,900
Two Cell Lagoon	16	11,512
Three Cell Lagoon	2	5,297
Four Cell Lagoon	1	2,246
Trickling Filter	11	266,059
Activated Sludge	1	6,000
Imhoff-Trickling Filter	2	2,139
Total		297,153
No Treatment	21	5,286

*Main Stem of the Des Moines River below Raccoon River Confluence

TABLE V-5

DES MOINES RIVER BASIN
MUNICIPAL WASTEWATER TREATMENT
FACILITY PROCESS SUMMARY

Type of Facility	Communities Served	Population Served
Trickling Filter	48	418,439
Activated Sludge	2	6,710
Single Cell Lagoon	18	12,971
Two Cell Lagoon	44	31,100
Three Cell Lagoon	6	7,000
Four Cell Lagoon	1	2,246
Septic Tank	2	453
Imhoff Tank	2	2,328
Imhoff Tank-Trickling Filter	11	10,192
Total	134	491,439
NEMTF*	86	19,786

*No Existing Municipal Treatment Facilities

CHAPTER VI - WASTE LOAD ALLOCATIONS AND RANKING

Using a computer methodology, effluent limitations required for dischargers to meet Iowa Water Quality Standards within the basin were determined. Waste load allocation analyses were performed assuming projected 1990 wastewater discharges at the 7-day, 1-in-10 year low flow under both summer and winter conditions. Analyses were performed on streams classified either A, B, or C with existing wastewater discharges. Some considerations that went into the analysis are discussed below. A detailed description of the computer methodology and the assumptions used can be found in the Supporting Document (1). The waste load allocations are listed in Table VI-1. The effluent limitations for all dischargers in the Des Moines River Basin not appearing in Table VI-1 is either secondary treatment or BPT.

Considerations

Four basic considerations go into the selection of the specific effluent limitations for any given discharge. These involve secondary treatment as defined by the EPA and the DEQ, best practicable control technology currently available (BPT), applicable water quality standards, and Iowa's antidegradation requirement.

Secondary Treatment - The Act requires that all publicly owned treatment works shall, by July 1, 1977, achieve, as

TABLE VI-1

WASTE LOAD ALLOCATIONS

Discharger (Reference Number)	Stream Flow (MGD)	1990 Discharger (MGD)	Summer		Winter	
			BOD5 (mg/l)/(lbs/day)	Ammonia-N (mg/l)/(lbs/day)	BOD5 (mg/l)/(lbs/day)	Ammonia-N (mg/l)/(lbs/day)
Blue Earth River						
None						
Des Moines River						
West Fork Des Moines River						
Wadco Foods, Inc. 5/ (I-1)	0.31					
Estherville (M-5)	0.31	2.51	30/628	2/42	10/209	2/42
Morrell and Co. 5/ (I-3)	0.31					
Graettinger (M-8)	3.12	Controlled Discharge				
Emmetsburg (M-9)	3.71	0.55	30/138	10/45	10/45	2/9

1/ As given on NPDES permit.

2/ BOD and ammonia discharge quantities should be in accordance with final standard industrial classification, "Best Practicable Waste Treatment Technology."

3/ Quarry dewatering and rock washing. No reported BOD or ammonia. Flow from quarry will be low or zero during low flow periods.

4/ Reported value of existing discharge.

5/ Discharge expected to be connected to city sewerage system.

TABLE VI-1

WASTE LOAD ALLOCATIONS

Discharger (Reference Number	Stream Flow (MGD)	1990 Discharger (MGD)	Summer		Winter	
			BOD$_5$ (mg/1)/(lbs/day)	Ammonia-N (mg/1)/(lbs/day)	BOD$_5$ (mg/1)/(lbs/day)	Ammonia-N (mg/1)/(lbs/day)
Emmetsburg Rendering Works (I-5)	3.71	---------- CLOSED ----------				
West Bend (M-13)	5.19	0.076	30/19	10/6	30/19	15/10
Rolfe (M-17)	5.47	Controlled Discharge				
P & M Stone 3/ (I-6)	5.53					
Humboldt (M-20)	5.64	0.926	30/232	10/77	30/232	9/68
East Fork Des Moines River						
Armstrong (M-22)	0.0	Controlled Discharge				
Swea City (M-23)	0.0	Controlled Discharge				
Bancroft (M-24)	0.0	Controlled Discharge				
Burt (M-25)	0.0	Controlled Discharge				
Titonka (M-26)	0.0	.057	30/14	10/5	30/14	15/7
Ringsted (M-27)	0.0	Controlled Discharge				
Oak Lake Development (S-106)	1.04	Controlled Discharge				
Algona (M-30)	3.40	0.900	30/225	9/68	30/225	6/45

TABLE VI-1

WASTE LOAD ALLOCATIONS

Discharger (Reference Number)	Stream Flow (MGD)	1990 Discharger (MGD)	Summer BOD_5 (mg/1)/(lbs/day)	Summer Ammonia-N (mg/1)/(lbs/day)	Winter BOD_5 (mg/1)/(lbs/day)	Winter Ammonia-N (mg/1)/(lbs/day)
Burr Oak Manor (S-11)	3.40	0.011	30/3	10/1	30/3	15/1.4
Livermore (M-31)	.42	Controlled Discharge				
Lotts Creek						
Whittemore (M-32)	.07	0.151	30/38	2/2.5	30/38	2/2.5
Bode (M-33)	.41	Controlled Discharge				
East Fork Des Moines River						
Dakota City (M-36)	6.1	0.042	30/11	10/3.5	30/11	15/5
Des Moines River						
Corn Belt Power Coop 4/ (I-8)	12.14	30.00	1.0/--	0.2/--	1.0/--	0.2/--
Farmegg Production, Inc. (I-14)	12.30	Complete Retention System				
Badger (M-38)	12.36	Controlled Discharge				
Hormel & Co. 4/ (I-20)	13.03	0.315	5/--	1/--	5/--	0/--
Fort Dodge Creamery 2/ (I-21)	13.03	0.200	Cooling Water Discharge			
American Can Co. 2/ (I-22)	13.03	0.020	Cooling Water Discharge			
Fort Dodge (M-45)	13.03	4.322	30/1081	8/228	30/1081	4/144

TABLE VI-1

WASTE LOAD ALLOCATIONS

Discharger (Reference Number)	Stream Flow (MGD)	1990 Discharger (MGD)	Summer		Winter	
			BOD_5 (mg/1)/(lbs/day)	Ammonia-N (mg/1)/(lbs/day)	BOD_5 (mg/1)/(lbs/day)	Ammonia-N (mg/1)/(lbs/day)
I B P (I-25)	17.92	Controlled Discharge				
Land O' Lakes, Inc. (I-24)	17.92	0.576	15/72	2/10	15/72	2/10
Savage S.D. (M-46)	18.53	0.05	30/13	10/4	30/13	15/6
Webster Processing Co. (I-28)	18.53	Complete Retention System				
United States Gypsum Co. 4/ (I-27)	18.53	0.223	5/9	0/--	5/9	0/--
National Gypsum 4/ (I-29)	18.53	0.078	10/--	1/--	10/--	1/--
Otho (M-47)	18.53	Controlled Discharge				
Farmland Industries (I-31)	18.90	Controlled Discharge				
Lehigh (M-48)	19.05	Controlled Discharge				
Dickey Clay Mfg. 5/ (I-33)	19.05	0.050				
Boone River						
Corwith (M-51)	0.0	Controlled Discharge				
Britt (M-52)	0.0	0.23	30/58	10/19	30/58	2/4
Renwick (M-55)	0.23	Controlled Discharge				
Goldfield (M-57)	0.23	Controlled Discharge				

TABLE VI-1

WASTE LOAD ALLOCATIONS

Discharger (Reference Number)	Stream Flow (MGD)	1990 Discharger (MGD)	Summer		Winter	
			BOD$_5$ (mg/1)/(lbs/day)	Ammonia-N (mg/1)/(lbs/day)	BOD5 (mg/1)/(lbs/day)	Ammonia-N (mg/1)/(lbs/day)
Boone Valley Coop (I-35)	0.23	0.155	10/13	2/3	10/13	2/3
Iowa Public Service 4/ (I-36)	0.23	0.016	5/--	0/--	5/--	0/--
Eagle Grove (M-59)	0.23	0.560	30/140	2/9	30/140	2/9
Clarion (M-60)	0.96	0.28	30/70	2/5	30/70	2/5
Franklin Mfg. 5/ (I-37)	1.24					
Webster City (M-62)	1.24	2.06	30/515	2/34	30/515	2/34
Des Moines River						
Stratford (M-63)	23.31	0.070	30/18	10/6	30/18	15/9
Dayton (M-64)	23.44	0.174	30/44	10/15	30/44	15/22
Boone Co. Home (S-22)	23.70	Controlled Discharge				
Episcopal Center & Conference Camp (S-23)	23.70	0.007	30/2	10/.6	30/2	15/.9
Boone (M-68)	26.33	2.407	30/602	10/201	30/602	5/100
Camp Laurie (S-21)	28.85	Controlled Discharge				
Woodward St. Institution (S-27)	28.85	0.20	30/50	10/17	30/50	15/25
Sheldahl (M-221)	29.23	Controlled Discharge				
Polk City (M-71)	29.23	Controlled Discharge				

TABLE VI-1

WASTE LOAD ALLOCATIONS

Discharger (Reference Number)	Stream Flow (MGD)	1990 Discharger (MGD)	Summer		Winter	
			BOD$_5$ (mg/l)/(lbs/day)	Ammonia-N (mg/l)/(lbs/day)	BOD$_5$ (mg/l)/(lbs/day)	Ammonia-N (mg/l)/(lbs/day)
Ankeny Ind. (M-154-2)	133.26	0.130	30/33	10/11	30/33	15/16
Beaver Creek						
Grand Junction (M-117)	0	0.040	30/10	10/3	30/10	15/5
Ogden (M-73)	0	0.176	30/44	10/15	30/44	15/22
Woodward (M-75)	0.28	Controlled Discharge				
Town & Country, Inc. (S-32)	0.28	Controlled Discharge				
Granger (M-77)	0.28	Controlled Discharge				
Grimes (M-78)	1.91	0.131	5/11	2/2	5/11	2/2
Beaver Valley Canning Co. 5/ (I-43)	1.91					
Urbandale S.D. (M-79)	2.64	0.875	5/36	2/15	5/36	2/15
Des Moines River						
Ankeny W. (M-154-1)	133.26	1.707	30/427	10/142	30/427	15/213
Mid-Continent Industries 1/ (I-45)	133.35	0.05	25/10	--/--	25/10	--/--
North Raccoon River						
Rembrandt (M-82)	0	Controlled Discharge				

TABLE VI-1

WASTE LOAD ALLOCATIONS

Discharger (Reference Number)		Stream Flow (MGD)	1990 Discharger (MGD)	Summer BOD$_5$ (mg/1)/(lbs/day)	Summer Ammonia-N (mg/1)/(lbs/day)	Winter BOD$_5$ (mg/1)/(lbs/day)	Winter Ammonia-N (mg/1)/(lbs/day)
Albert City (M-82)		0.01	0.085	30/21	10/7	30/21	8/6
Iowa Public Service Company (I-48)	4/	0.10	0.016	5/--	1/--	5/--	1/--
Storm Lake (M-84)		0.10	3.090	30/773	3/77	30/773	2/51
Storm Lake Industrial (M-85)	5/	0.10					
Country Village MHP (S-37)		0.10	Controlled Discharge				
Vilas & Company (I-49)	4/	0.10	0.099	0/--	0.5/--	0/--	0.5/--
Vista Prod. (I-50)		0.10	0.18	30/45	2/3	No Discharge	
Sac City (M-87)		3.49	0.28	30/70	10/23	30/70	2/5
Laurens (M-89)		3.77	0.160	30/40	10/13	30/40	2/3
Mefferd Industries (I-52)	2/	3.77	0.008				
Fonda (M-91)		3.77	0.093	30/23	10/8	30/23	2/2
Newell (M-92)		3.77	0.092	30/23	10/8	30/23	2/2
Lake View (M-93)		4.43	0.229	30/57	10/19	30/57	4/8
Lytton (M-96)		5.30	Controlled Discharge				
Pomeroy (M-98)		6.06	Controlled Discharge				

TABLE VI-1

WASTE LOAD ALLOCATIONS

Discharger (Reference Number)	Stream Flow (MGD)	1990 Discharger (MGD)	Summer BOD_5 (mg/1)/(1bs/day)	Summer Ammonia-N (mg/1)/(1bs/day)	Winter BOD_5 (mg/1)/(1bs/day)	Winter Ammonia-N (mg/1)/(1bs/day)
Rockwell City (M-99)	6.06	0.277	30/69	10/23	30/69	7/16
Rockwell City Women's Reformatory (S-43)	6.06	Controlled Discharge				
Lake City N. (M-100)	6.06	0.095	30/24	10/8	30/24	7/6
Lake City S.W. (M-101)	6.06	0.084	30/21	10/7	30/21	7/5
Manson (M-103)	8.39	Controlled Discharge				
Rinard (M-106)	8.39	0.008	30/2	10/1	30/2	15/1
Lohrville (M-107)	8.39	0.056	30/14	10/5	30/14	15/7
Scranton (M-108)	8.77	0.065	30/16	10/5	30/16	15/8
Jefferson (M-109)	8.95	0.606	30/152	10/51	30/152	6/30
Farnhamville (M-110)	10.53	Controlled Discharge				
Churdan (M-111)	10.53	Controlled Discharge				
Callender (M-112)	11.49	Controlled Discharge				
Gowrie (M-113)	11.49	0.081	30/20	10/7	30/20	15/10
Rippey (M-119)	12.07	Controlled Discharge				

TABLE VI-1

WASTE LOAD ALLOCATIONS

Discharger (Reference Number)	Stream Flow (MGD)	1990 Discharger (MGD)	Summer BOD$_5$ (mg/1)/(1bs/day)	Summer Ammonia-N (mg/1)/(1bs/day)	Winter BOD$_5$ (mg/1)/(1bs/day)	Winter Ammonia-N (mg/1)/(1bs/day)
Oscar Mayer & Co. (I-56)	13.42	1.233	33/339	9/93	33/339	4/41
Perry (M-121)	12.18	1.378	30/345	10/115	30/345	2/23
Iowa Electric Light & Power (I-57) 2/	13.42	0.002				
Minburn (M-122)	14.91	Controlled Discharge				
Adel (M-124)	15.17	0.224	30/56	10/19	30/56	15/28
South Raccoon River						
Guthrie Center (M-125)	2.22	0.196	30/49	10/16	30/49	15/25
Dedham (M-128)	3.98	Controlled Discharge				
Stuart (M-129)	6.38	0.203	30/50	10/17	30/50	15/25
Middle Raccoon River						
Breda (M-130)	0	Controlled Discharge				
Carroll (M-131)	0.84	1.075	30/269	10/90	30/269	5/45
Carroll Rendering Works (I-52)	0.84	0.080	33/22	25/17	33/22	10/7
Iowa Public Service Co. (I-61) 4/	0.84	0.025	1/--	1/--	1/--	1/--

TABLE VI-1

WASTE LOAD ALLOCATIONS

Discharger (Reference Number)	Stream Flow (MGD)	1990 Discharger (MGD)	Summer BOD$_5$ (mg/1)/(lbs/day)	Summer Ammonia-N (mg/1)/(lbs/day)	Winter BOD$_5$ (mg/1)/(lbs/day)	Winter Ammonia-N (mg/1)/(lbs/day)
Lidderdale (M-132)	3.09	Controlled Discharge				
Coon Rapids (M-134)	3.95	0.088	30/22	10/7	30/22	15/11
Glidden (M-135)	6.58	0.068	30/17	10/6	30/17	15/8
Panora (M-138)	10.22	Controlled Discharge				
Bagley (M-140)	10.22	0.039	30/10	10/5	30/10	15/5
South Raccoon River						
Redfield (M-142)	16.37	Controlled Discharge				
Norther Iowa Gas Co. (I-52) 2/	17.98					
Earlham (M-143)	18.01	Controlled Discharge				
Gendler Ston Co. (I-64) 2/	1801					
DeSoto (M-144)	18.48	Controlled Discharge				
Raccoon River						
Van Meter (M-145)	32.64	Controlled Discharge				
Waukee (M-146)	32.92	Controlled Discharge				
Dallas Center (M-123)	14.91	0.258	30/65	10/22	30/65	15/32

TABLE VI-1

WASTE LOAD ALLOCATIONS

Discharger (Reference Number)	Stream Flow (MGD)	1990 Discharger (MGD)	Summer BOD$_5$ (mg/l)/(lbs/day)	Summer Ammonia-N (mg/l)/(lbs/day)	Winter BOD$_5$ (mg/l)/(lbs/day)	Winter Ammonia-N (mg/l)/(lbs/day)
Skelly Oil Company 2/ (I-65)	33.4					
American Oil Company 2/ (I-66)	33.48					
Des Moines River						
Des Moines (M-150)	175.29	40.77	10/3400	2/680	30/10201	4/1360
Slater (M-152)	216.72	Controlled Discharge				
Ankeny E. (M-153)	216.72	2.992	30/749	10/250	30/749	15/375
Altoona (M-155)	216.72	1.513	30/379	10/126	30/379	15/189
Southeast Polk Comm. School (S-73)	216.72	0.013	30/3	10/1	30/3	15/2
Pleasant Hill (M-156)	223.85	0.220	30/55	10/18	30/55	15/28
Middle River						
Adair (M-164)	0.27	0.076	30/19	10/6	30/19	15/10
Casey (M-165)	0.27	0.059	30/15	10/5	30/15	15/7
Winterset (M-166)	0.41	0.446	10/37	3/11	10/37	3/11
Martensdale (M-169)	0.45	Controlled Discharge				
Truro (M-171)	0.45	Controlled Discharge				

TABLE VI-1

WASTE LOAD ALLOCATIONS

Discharger (Reference Number)	Stream Flow (MGD)	1990 Discharger (MGD)	Summer BOD$_5$ (mg/1)/(lbs/day)	Summer Ammonia-N (mg/1)/(lbs/day)	Winter BOD$_5$ (mg/1)/(lbs/day)	Winter Ammonia-N (mg/1)/(lbs/day)
Indianola N. (M-174)	1.24	1.034	10/86	2/17	10/86	3/26
Hartford MHP (S-80)	2.28	Controlled Discharge				
Des Moines River						
Sugar Creek						
Donnellson (M-219)	0.0	0.111	10/9	2/2	10/9	2/2
Sugar Valley Campground (S-103)	.111	Controlled Discharge				
Argyle School (S-104)	.111	Controlled Discharge				
Central High School (S-105)	.111	Controlled Discharge				

a minimum, secondary treatment. No municipal discharge is, therefore, allowed an effluent limitation less stringent than secondary treatment. Secondary treatment has been defined by the EPA and the DEQ as having the following concentrations in the effluent: 30 mg/l BOD_5, 30 mg/l suspended solids; or not less than 85 percent removal of BOD_5 and suspended solids; and 200 most probable number/100 ml fecal coliforms.

BPT - The Act requires that all point sources other than publicly owned treatment works shall, by July 1, 1977, achieve as a minimum, "best practicable control technology currently available" (BPT). No industrial discharge is, therefore, allowed an effluent limitation less stringent than BPT. BPT for various industrial processes is defined by the EPA in their industrial development documents.

Applicable Water Quality Standards - The ultimate reason for requiring any effluent limitation is the protection of water quality. The Iowa Water Quality Standards are designed to ensure a reasonable degree of protection. All discharges are, therefore, required to meet effluent limitations stringent enough to assure that water quality standards will be met. Where secondary treatment or BPT is not sufficient to meet the applicable water quality standards, a higher level of treatment is required.

Antidegradation - A policy on antidegradation has been adopted by the DEQ to assure that in those places where water quality significantly exceeds that of the standards, the present condition shall be maintained. New dischargers locating in areas of high quality water may, therefore, be required to meet effluent limitations more stringent than secondary treatment or BPT, even though a lesser degree of treatment might be sufficient to meet water quality standards.

ALLOCATION RESULTS

The waste load allocations are based upon a mathematical model. Based upon the available data, the model predicts stream quality when given the existing wastewater discharges. For the initial simulation, all discharges were assumed to meet either secondary treatment or BPT. Where the model indicated violations of Iowa Water Quality Standards, more stringent effluent limitations were imposed until standards were met. Both winter and summer conditions were evaluated in determining the waste load allocations for the study areas.

Upper Des Moines River

Summer Conditions - Dissolved oxygen and ammonia nitrogen concentration profiles for the West and East Fork Des Moines River, Lotts Creek, Boone River, and the main stem of the Upper Des Moines River are shown in Figures VI-1 to VI-5. The water quality criteria for dissolved oxygen is met in all sections of the streams with secondary treatment. The BOD waste load allocations are thus the same as secondary treatment. In order to meet the water quality criteria for ammonia nitrogen the communities of Estherville, Algona, Fort Dodge, Eagle Grove, Clarion, and Webster City must provide a level of ammonia removal exceeding that of secondary treatment.

Winter Conditions - Dissolved oxygen and ammonia nitrogen concentration profiles for sections of the Upper Des Moines

FIGURE VI - 1
DISSOLVED OXYGEN AND AMMONIA NITROGEN
CONCENTRATIONS
SUMMER CONDITIONS

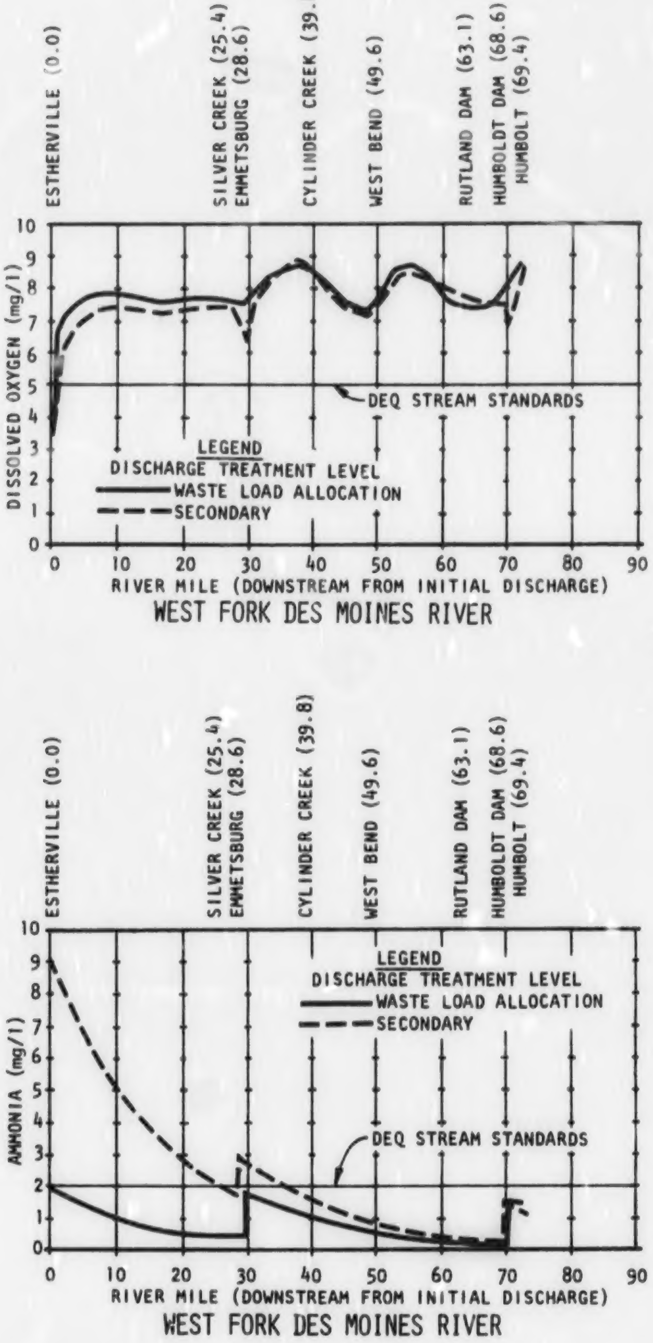


FIGURE VI - 2
DISSOLVED OXYGEN AND AMMONIA NITROGEN
CONCENTRATIONS
SUMMER CONDITIONS

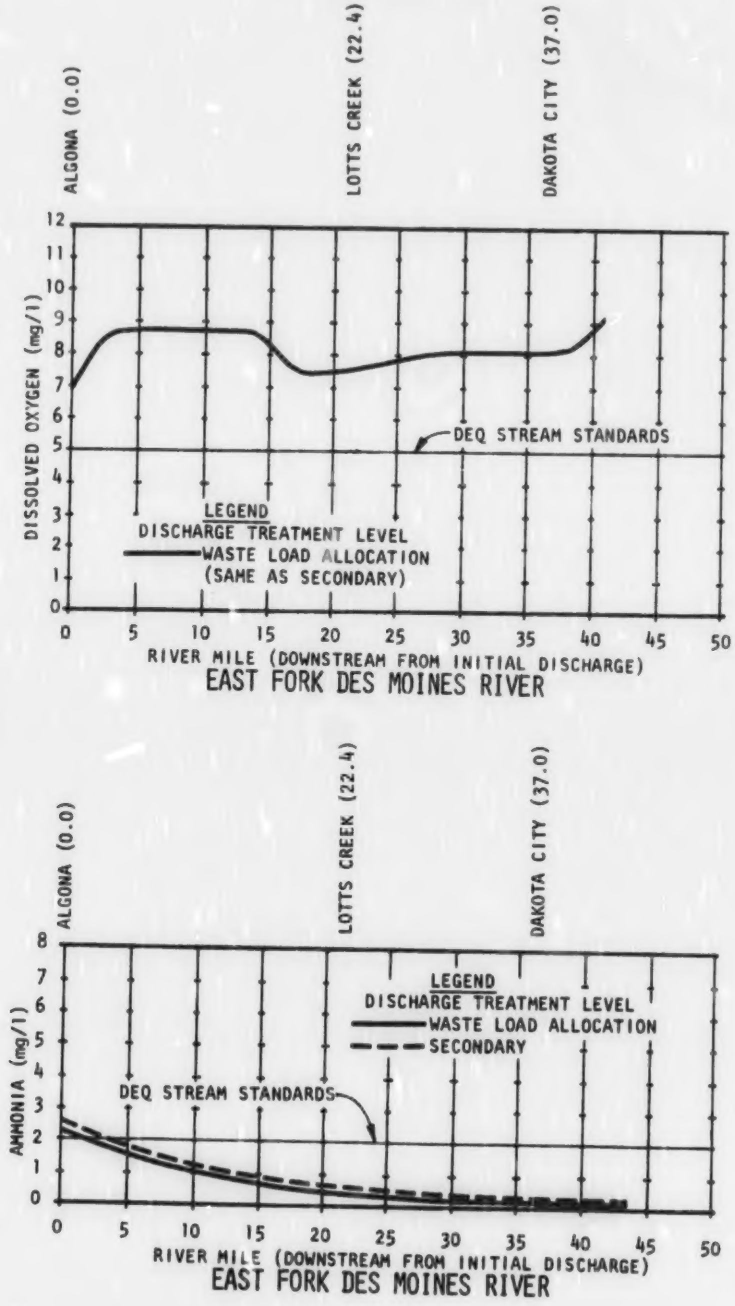
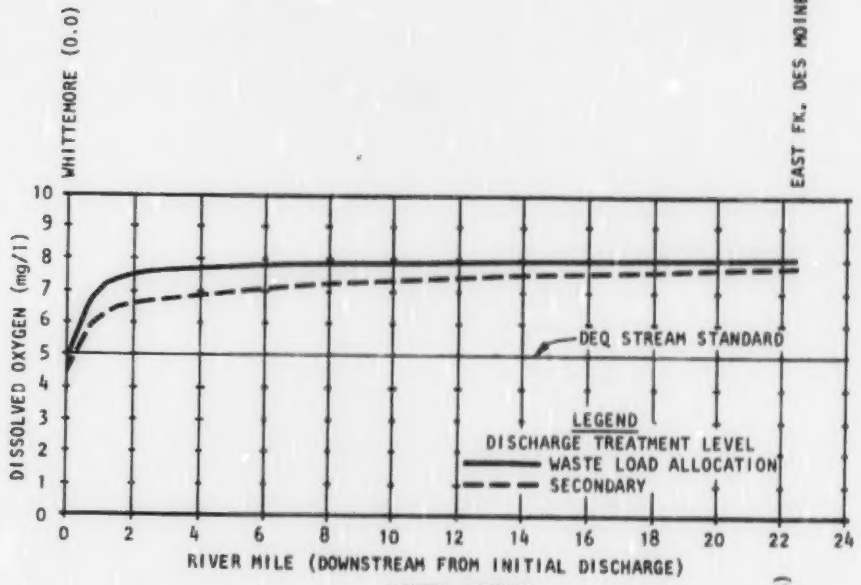
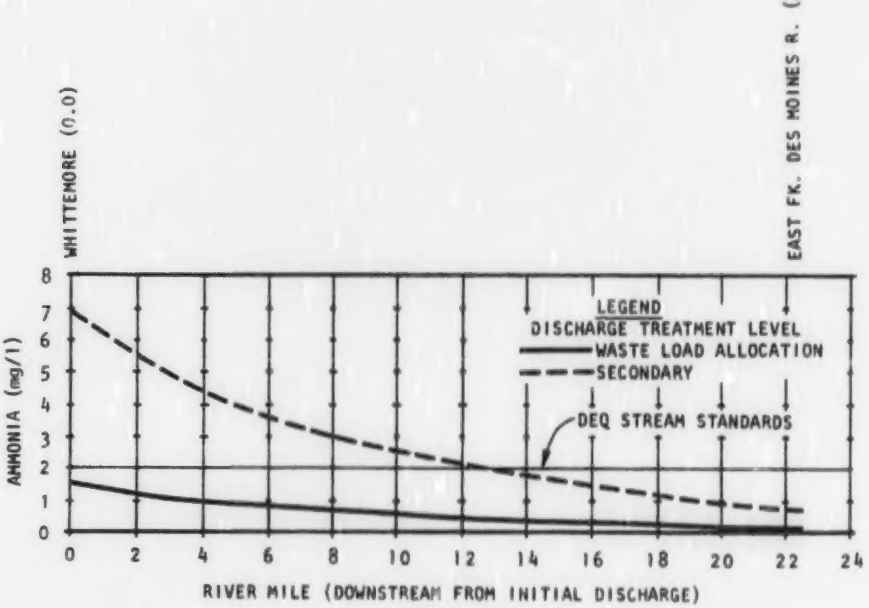


FIGURE VI - 3
DISSOLVED OXYGEN AND AMMONIA NITROGEN
CONCENTRATIONS
SUMMER CONDITIONS

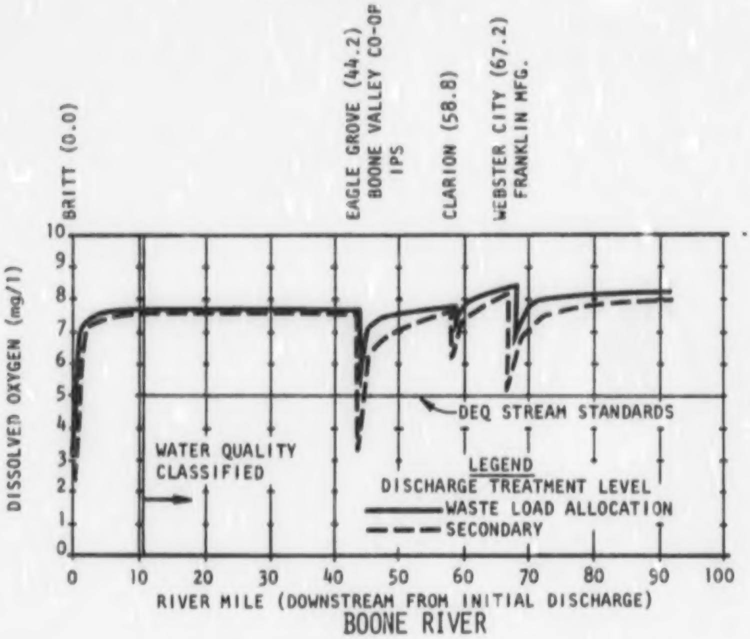


LOTTS CREEK



LOTTS CREEK

FIGURE VI - 4
DISSOLVED OXYGEN AND AMMONIA NITROGEN
CONCENTRATIONS
SUMMER CONDITIONS



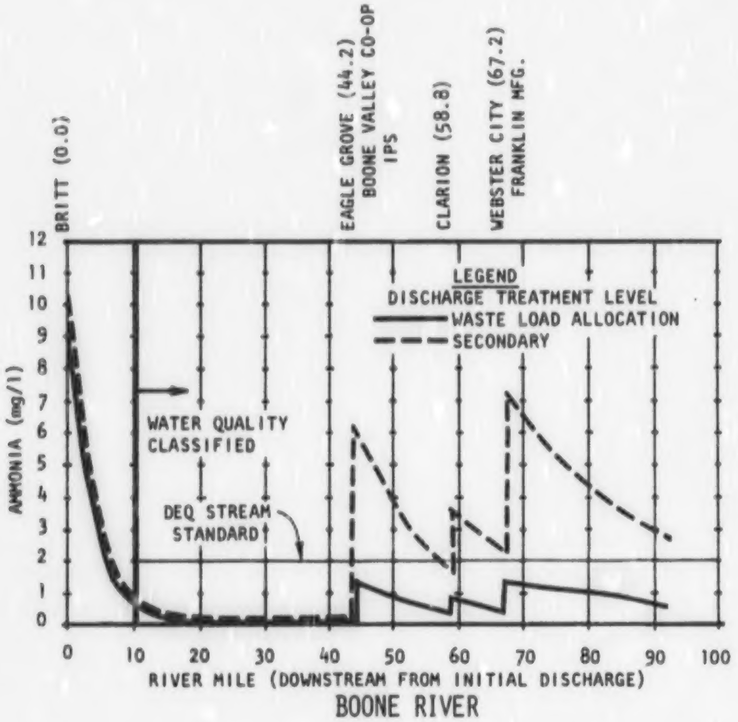
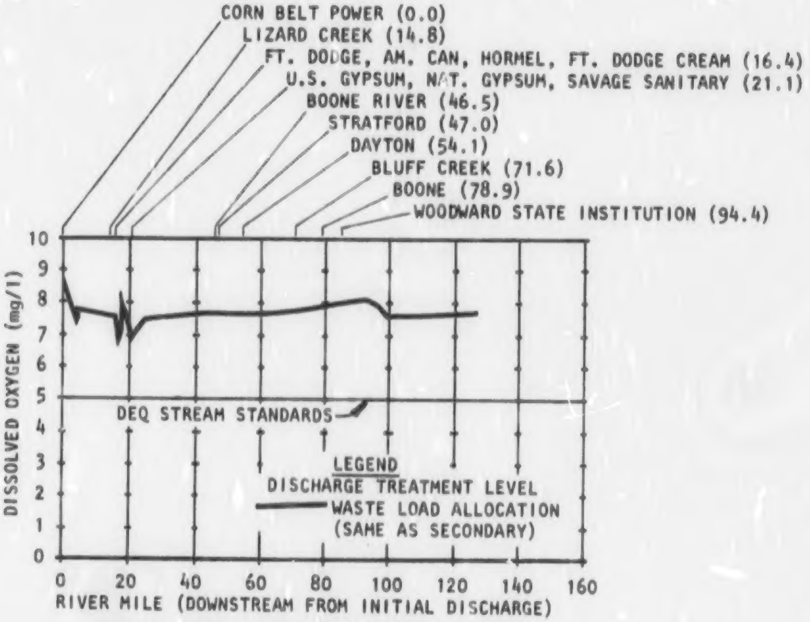
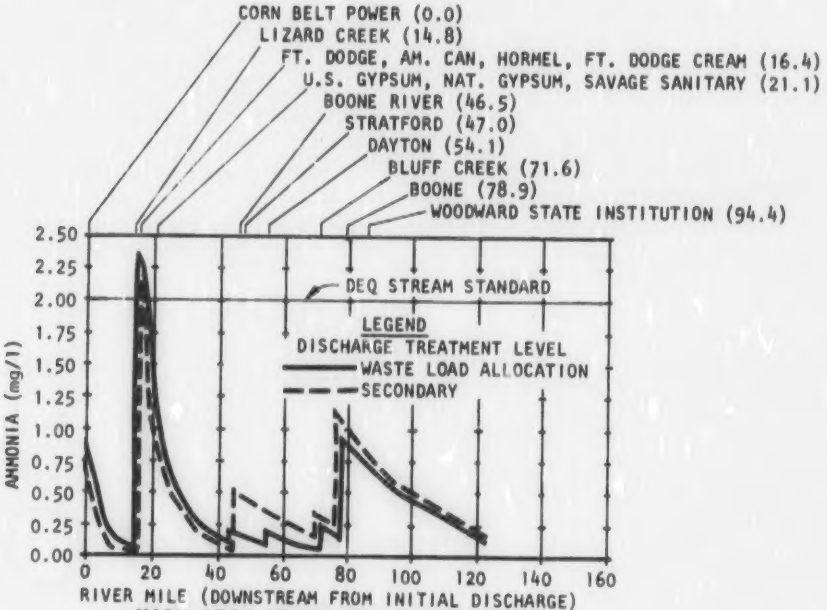


FIGURE VI - 5
DISSOLVED OXYGEN AND AMMONIA NITROGEN
CONCENTRATIONS
SUMMER CONDITIONS



MAIN STEM UPPER DES MOINES RIVER



MAIN STEM UPPER DES MOINES RIVER

River under winter conditions are shown in Figures VI-6 to VI-10. Secondary treatment or BPT for BOD are sufficient to meet the water quality criteria for dissolved oxygen, with the exception of the City of Estherville, which must provide more advanced BOD treatment. Ammonia removal exceeding that of secondary treatment will be necessary for the discharges from Estherville, Emmetsburg, Humboldt, Algona, Whittemore, Fort Dodge, Britt, Eagle Grove, Clarion, Webster City, and the City of Boone in order to meet the water quality criteria for ammonia nitrogen.

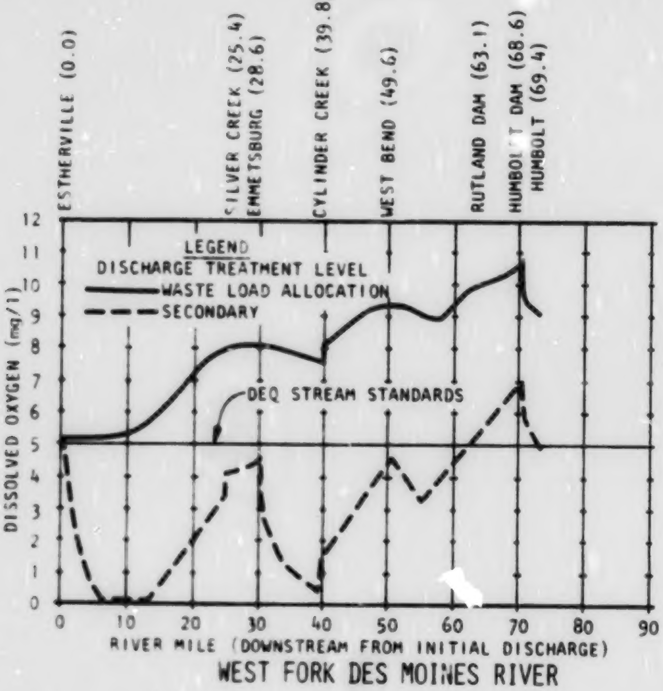
Raccoon River

Summer Conditions - Dissolved oxygen concentration profiles for the South Raccoon River, Middle Raccoon River, North Raccoon River, and Raccoon River are shown on Figures VI-11 and VI-12. The water quality criteria for dissolved oxygen is met in all sections of the streams with secondary treatment. The BOD waste load allocations are thus the same as secondary treatment.

Ammonia nitrogen concentration profiles are shown on Figures VI-13 and VI-14 for the South Raccoon River, Middle Raccoon River, North Raccoon River, and Raccoon River.

The ammonia nitrogen waste load allocations required to meet stream standards are equivalent to secondary for all dischargers with the exception of the community of Storm Lake and the Oscar Mayer plant at Perry. Only these two

FIGURE VI - 6
DISSOLVED OXYGEN AND AMMONIA NITROGEN
CONCENTRATIONS
WINTER CONDITIONS



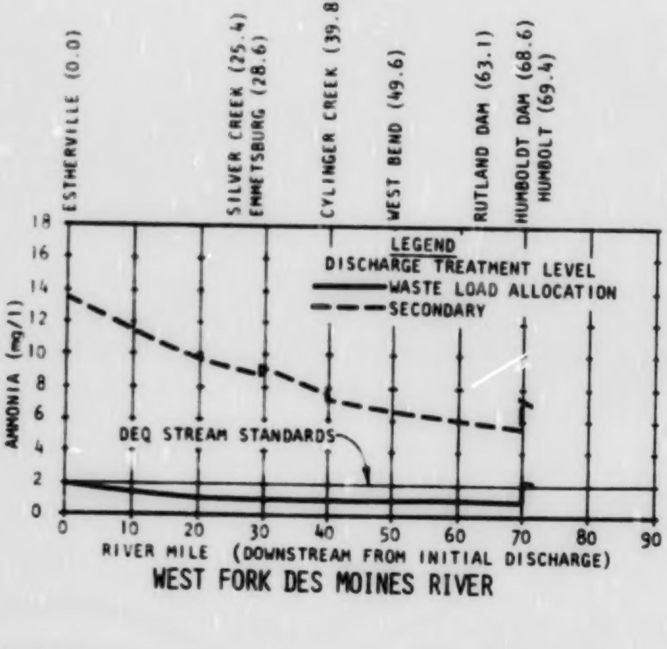
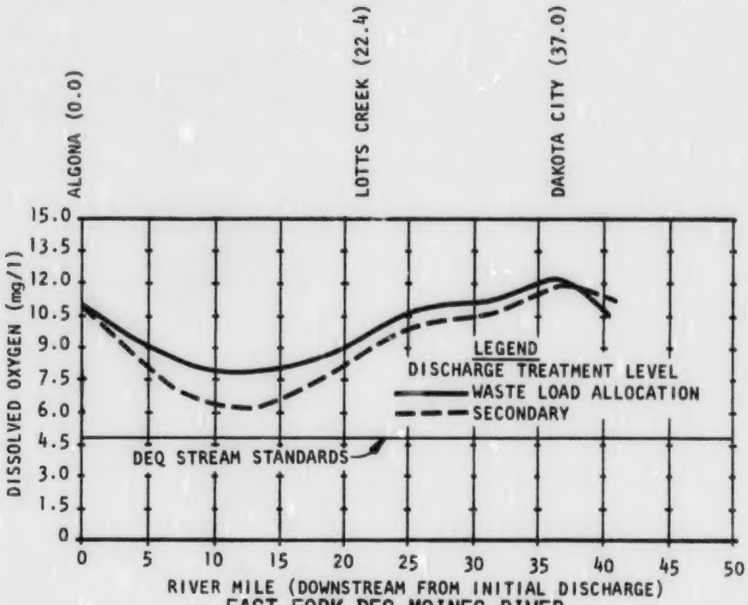
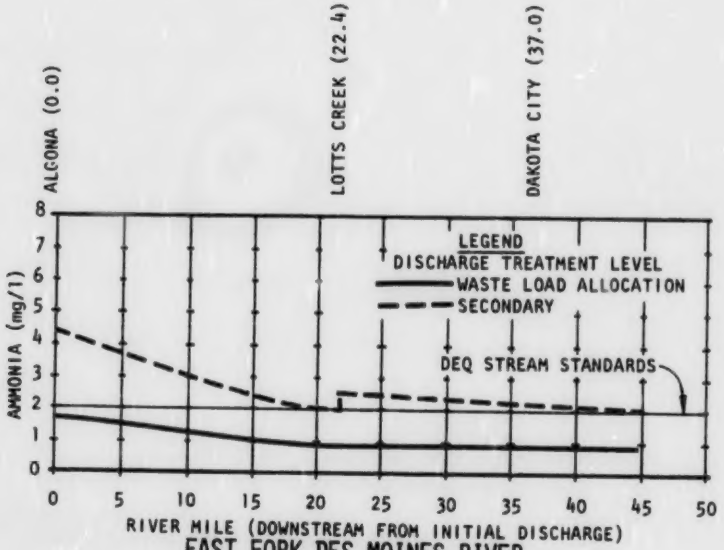


FIGURE VI - 7
DISSOLVED OXYGEN AND AMMONIA NITROGEN
CONCENTRATIONS
WINTER CONDITIONS



EAST FORK DES MOINES RIVER



EAST FORK DES MOINES RIVER

FIGURE VI - 8
DISSOLVED OXYGEN AND AMMONIA NITROGEN
CONCENTRATIONS
WINTER CONDITIONS

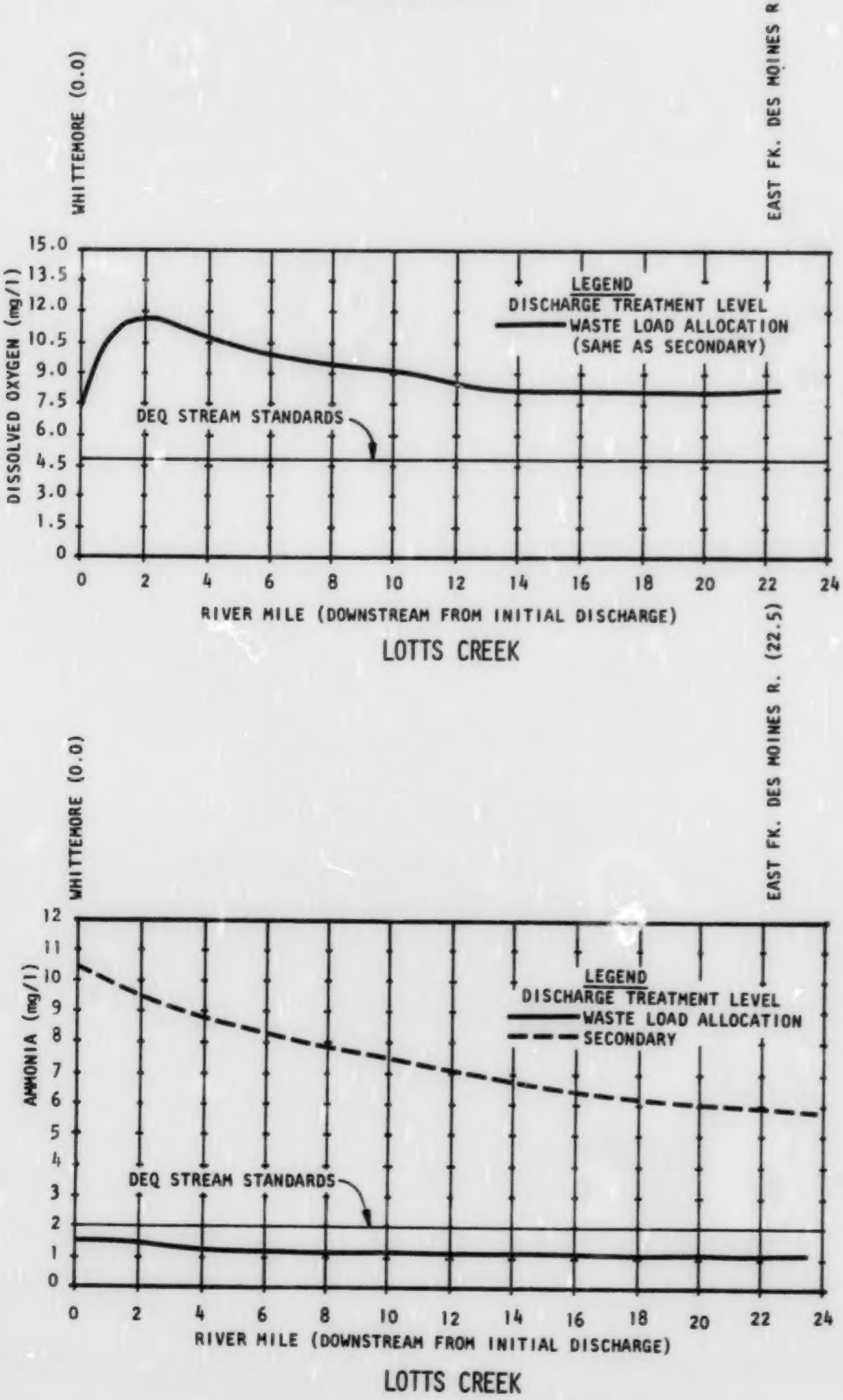
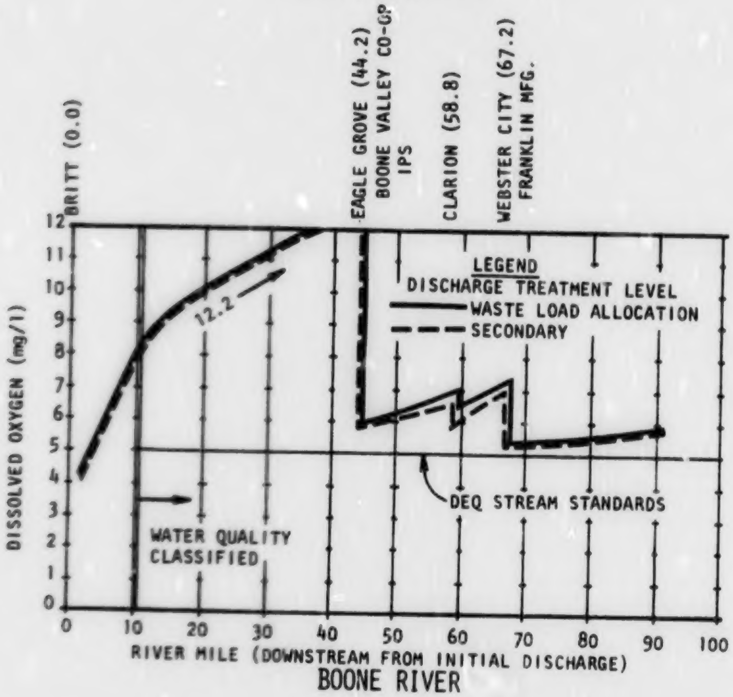


FIGURE VI - 9
DISSOLVED OXYGEN AND AMMONIA NITROGEN CONCENTRATIONS WINTER CONDITIONS



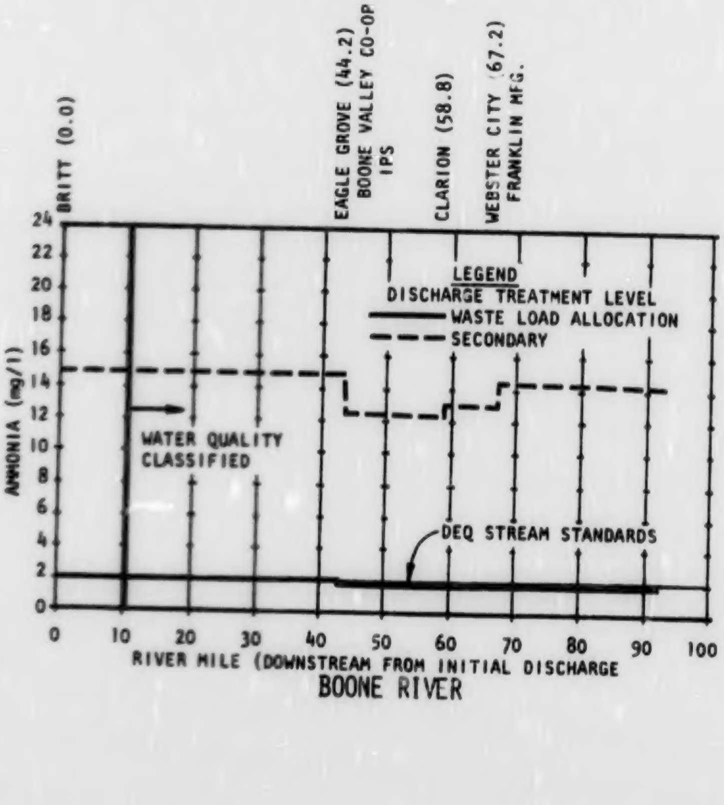
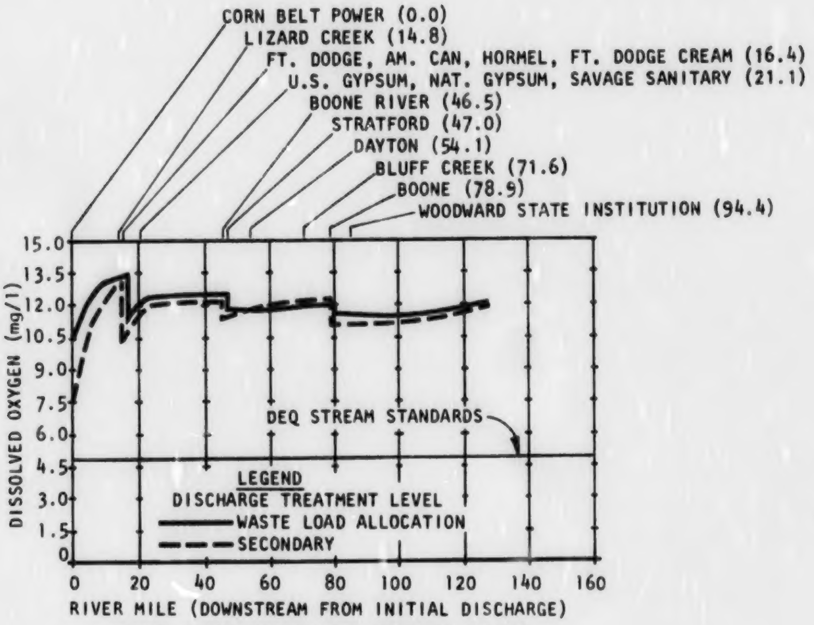
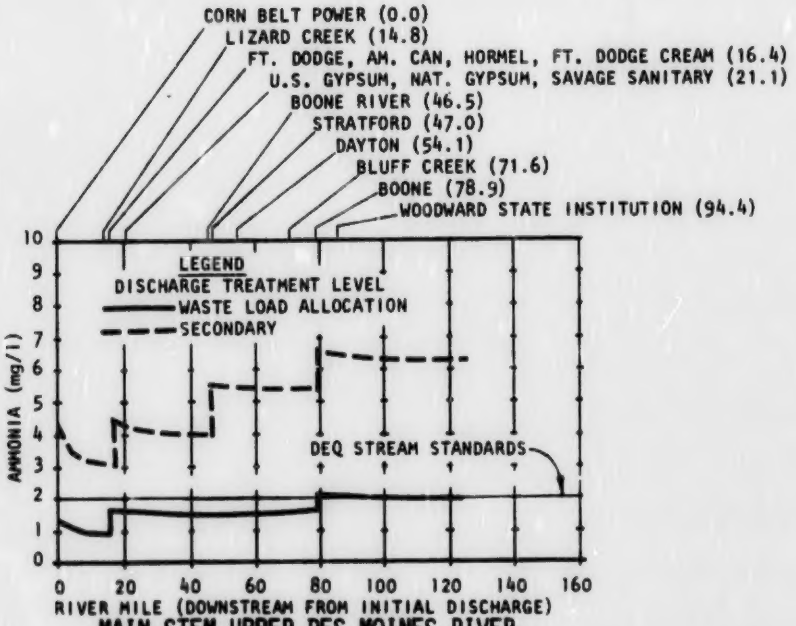


FIGURE VI - 10
DISSOLVED OXYGEN AND AMMONIA NITROGEN
CONCENTRATIONS
WINTER CONDITIONS

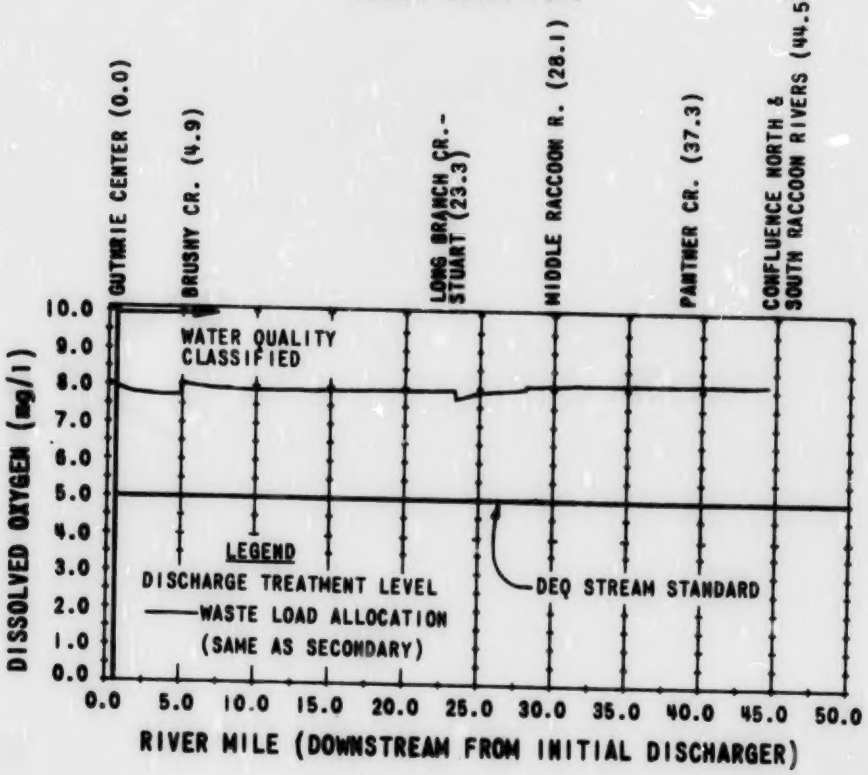


MAIN STEM UPPER DES MOINES RIVER

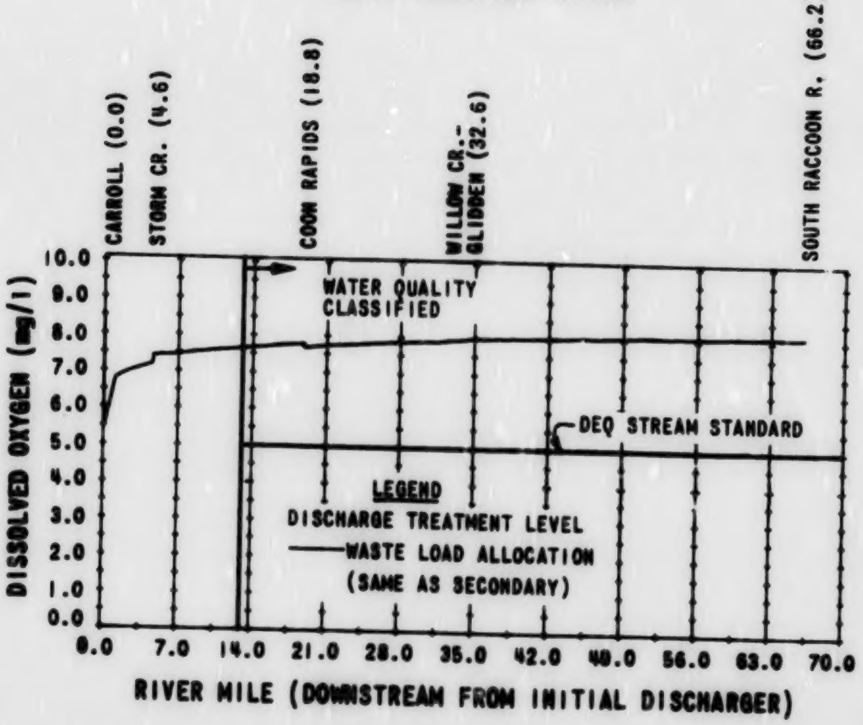


MAIN STEM UPPER DES MOINES RIVER

FIGURE VI-11
DISSOLVED OXYGEN CONCENTRATIONS
SUMMER CONDITIONS

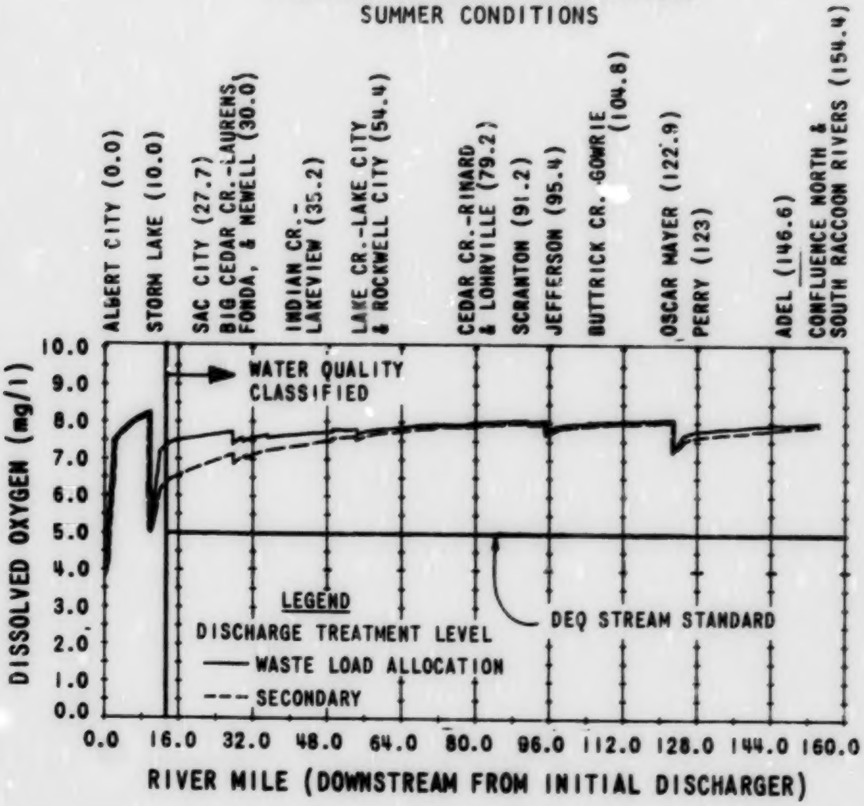


SOUTH RACCOON RIVER

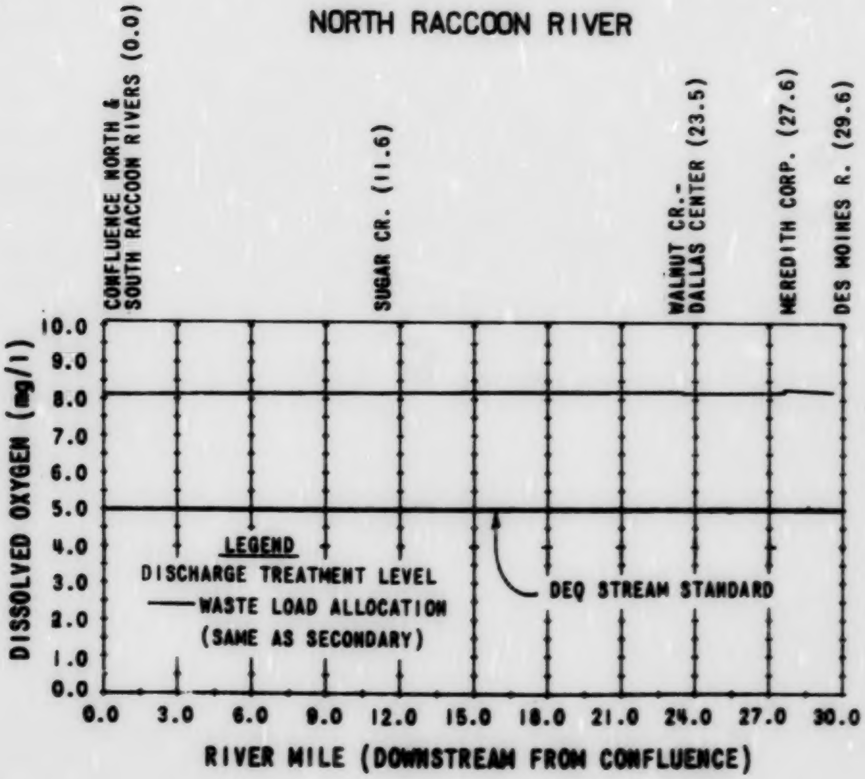


MIDDLE RACCOON RIVER

FIGURE VI-12
DISSOLVED OXYGEN CONCENTRATIONS
SUMMER CONDITIONS

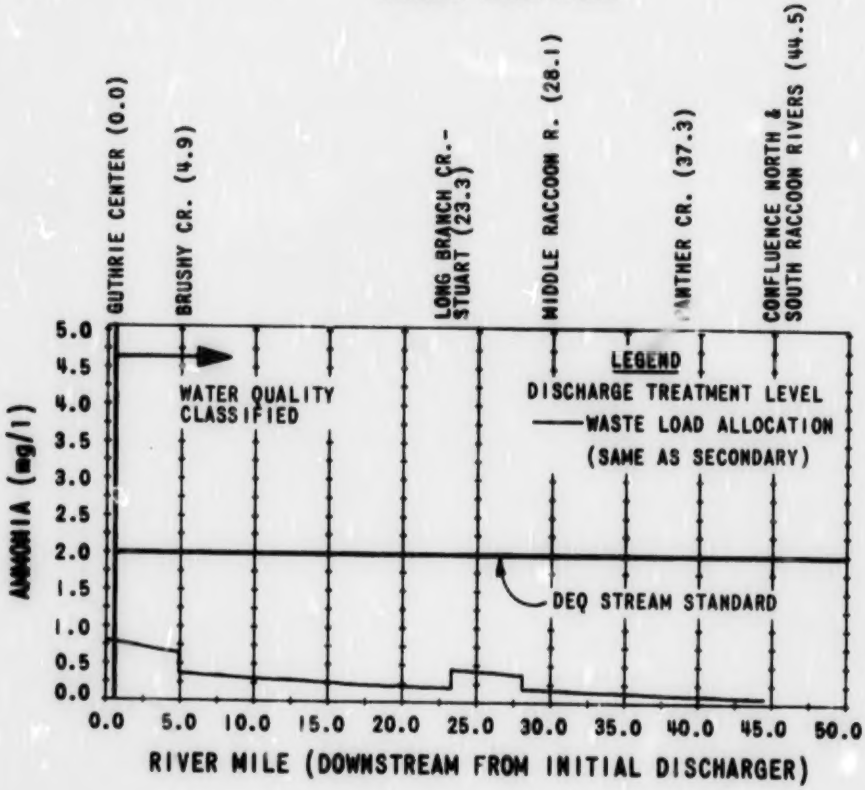


NORTH RACCOON RIVER

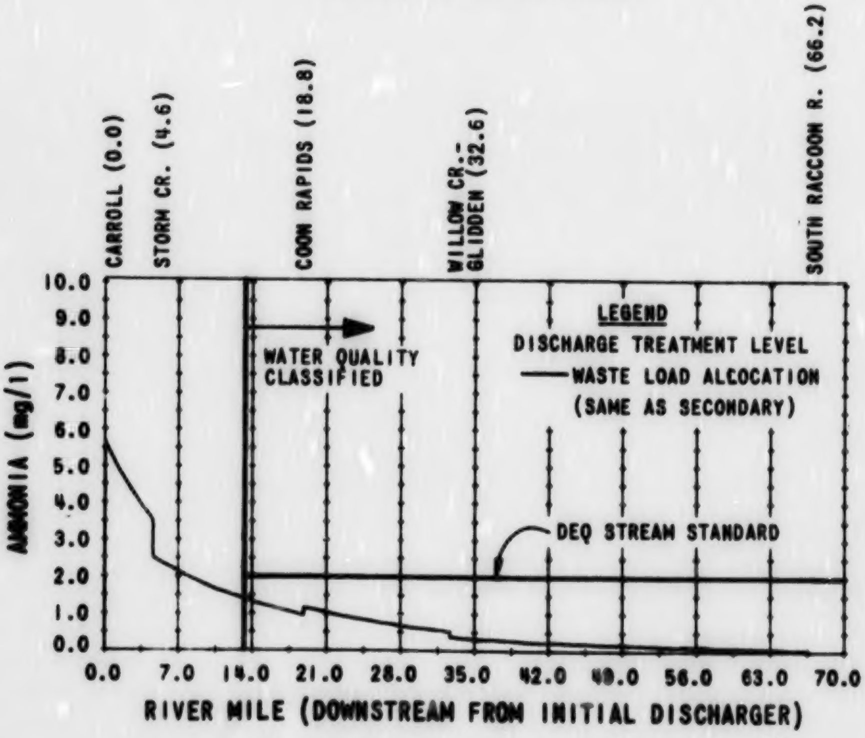


RACCOON RIVER

FIGURE VI-13
AMMONIA NITROGEN CONCENTRATIONS
SUMMER CONDITIONS

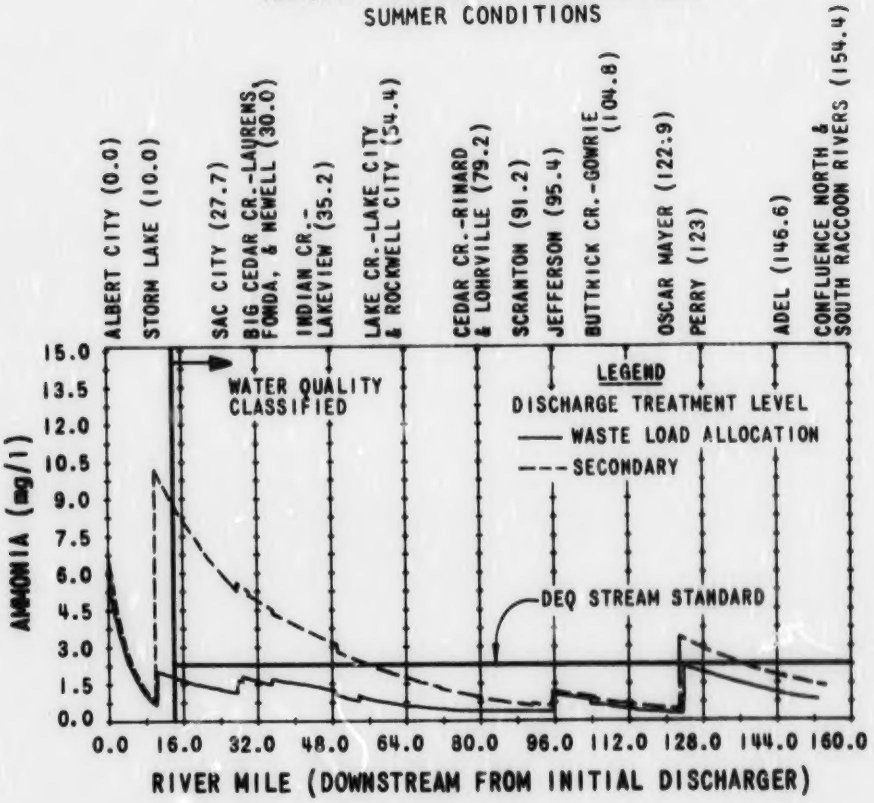


SOUTH RACCOON RIVER

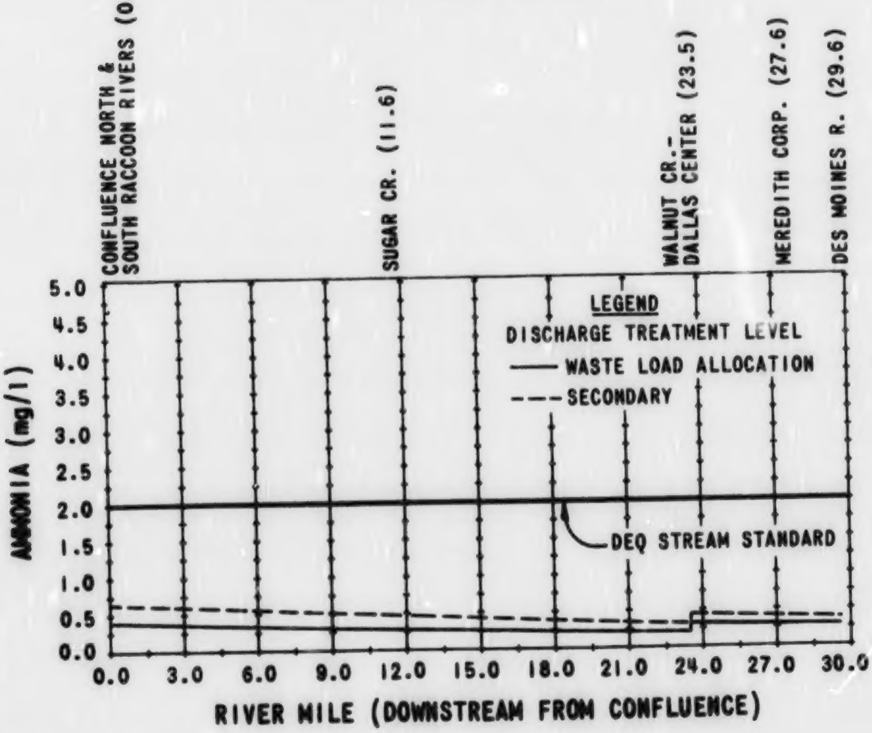


MIDDLE RACCOON RIVER

FIGURE VI-14
AMMONIA NITROGEN CONCENTRATIONS
SUMMER CONDITIONS



NORTH RACCOON RIVER



RACCOON RIVER

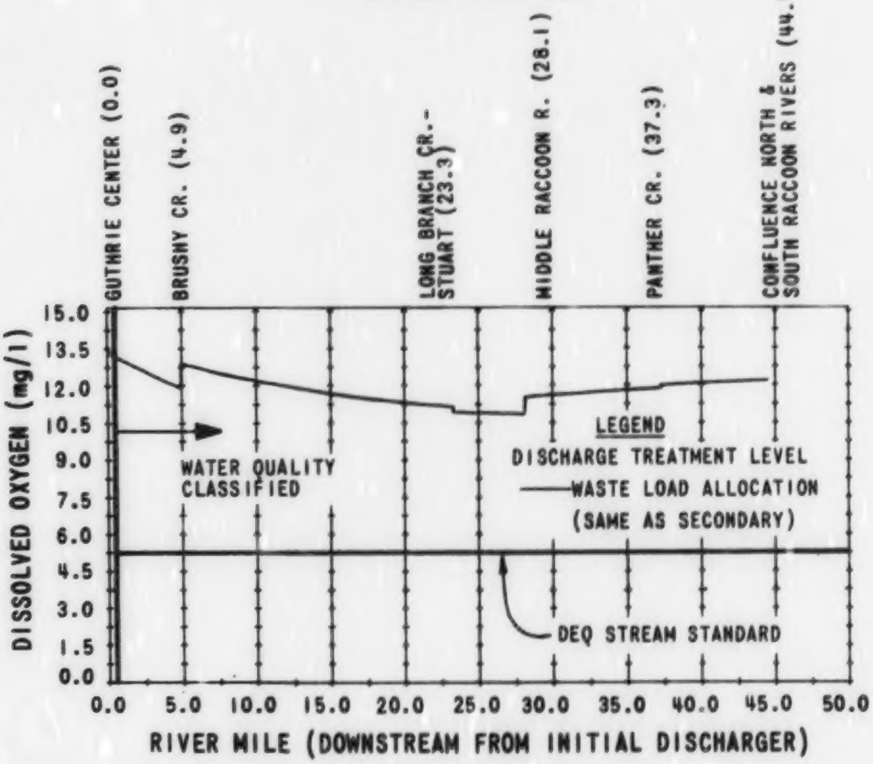
discharges must provide ammonia removal exceeding that of secondary treatment.

Winter Conditions - Dissolved oxygen concentration profiles for the South Raccoon River, Middle Raccoon River, North Raccoon River, and Raccoon River are shown on Figures VI-15 and VI-16. The water quality criteria for dissolved oxygen is met in all sections of the streams with secondary treatment. The BOD waste load allocations are thus the same as secondary treatment.

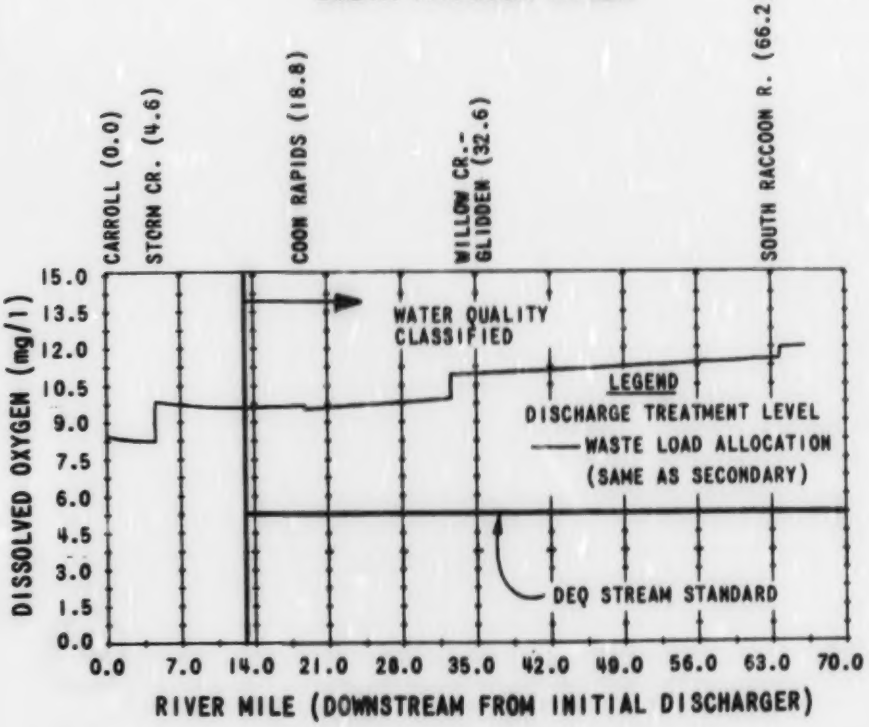
Ammonia nitrogen concentration profiles for the streams under winter low flow conditions are shown on Figures VI-17 and VI-18. The water quality criteria for ammonia nitrogen is met for all classified sections of the stream for given waste load allocations. With only secondary treatment, ammonia nitrogen concentrations in the stream violate stream quality criteria. Ammonia nitrogen concentrations within the streams are not reduced as appreciably in the winter as during the summer because of the lack of bio-oxidation of ammonia at low temperatures.

The water quality criteria for ammonia nitrogen can be met by secondary treatment of all wastewater discharges with the exception of two areas. The community of Carroll on the Middle Raccoon River and all communities along the North Raccoon River; with the exception of Lohrville, Rinard, Scranton, Gowrie, and Adel must provide ammonia removal exceeding that of secondary treatment to meet water quality standards.

FIGURE VI-15
DISSOLVED OXYGEN CONCENTRATIONS
WINTER CONDITIONS

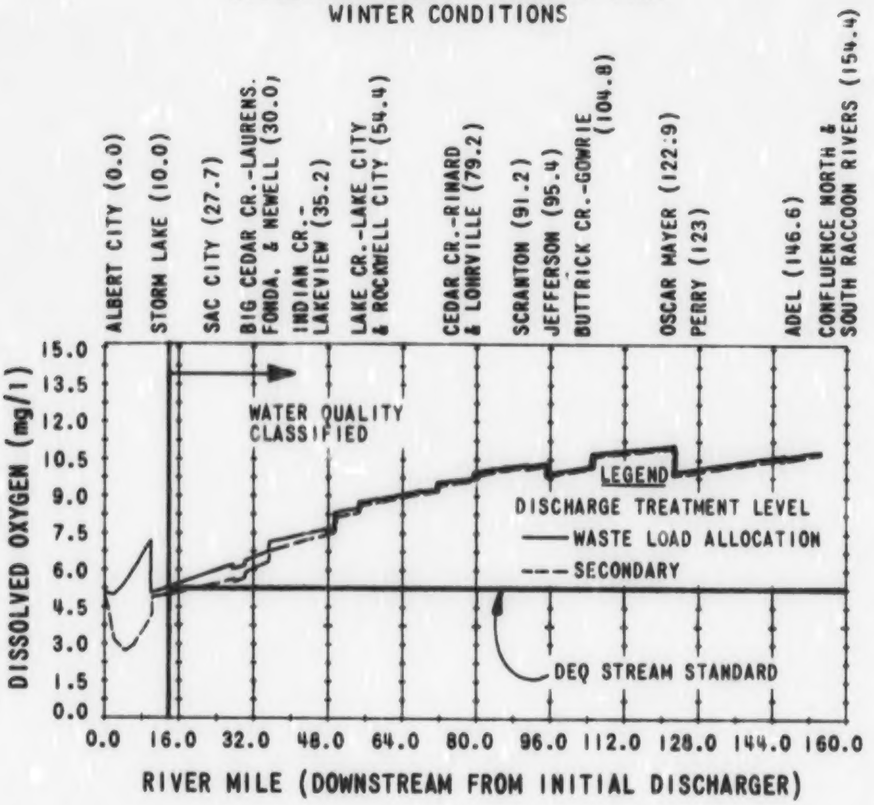


SOUTH RACCOON RIVER

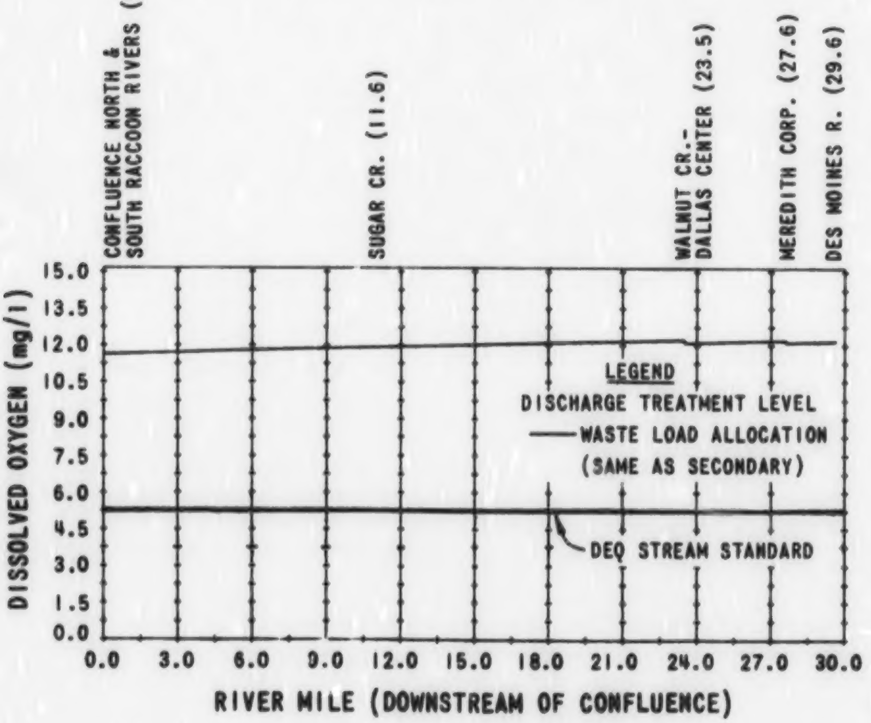


MIDDLE RACCOON RIVER

FIGURE VI-16
DISSOLVED OXYGEN CONCENTRATIONS
WINTER CONDITIONS

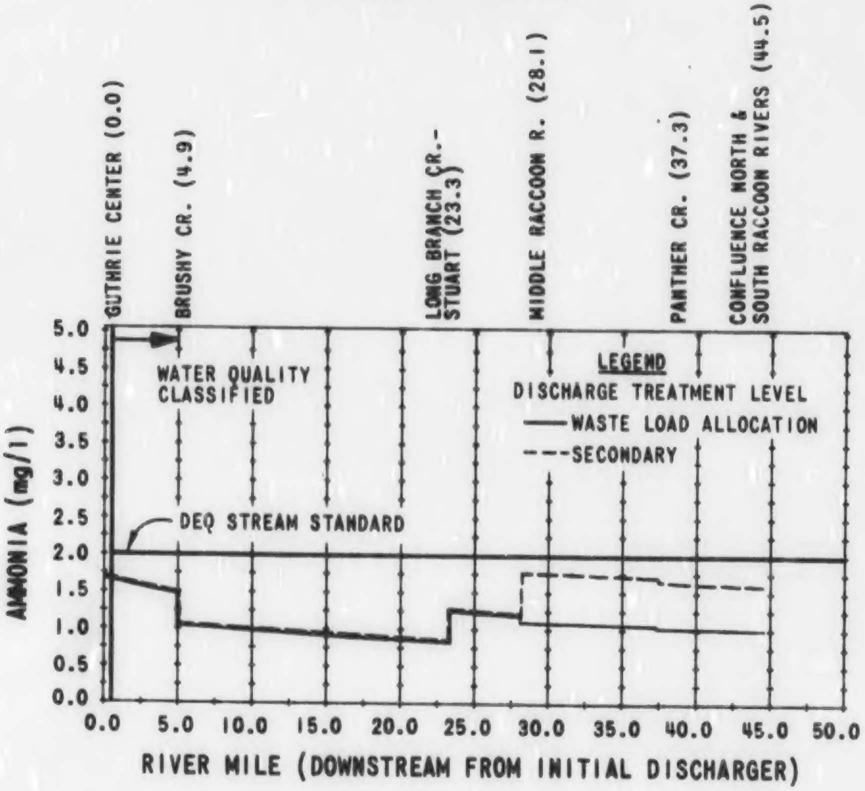


NORTH RACCOON RIVER

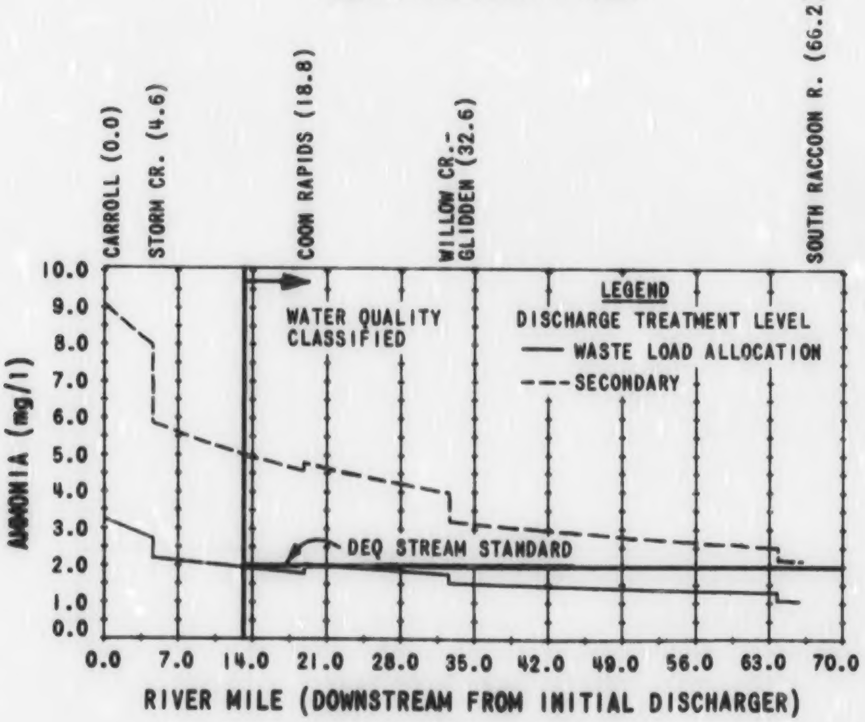


RACCOON RIVER

FIGURE VI-17
AMMONIA NITROGEN CONCENTRATIONS
WINTER CONDITIONS

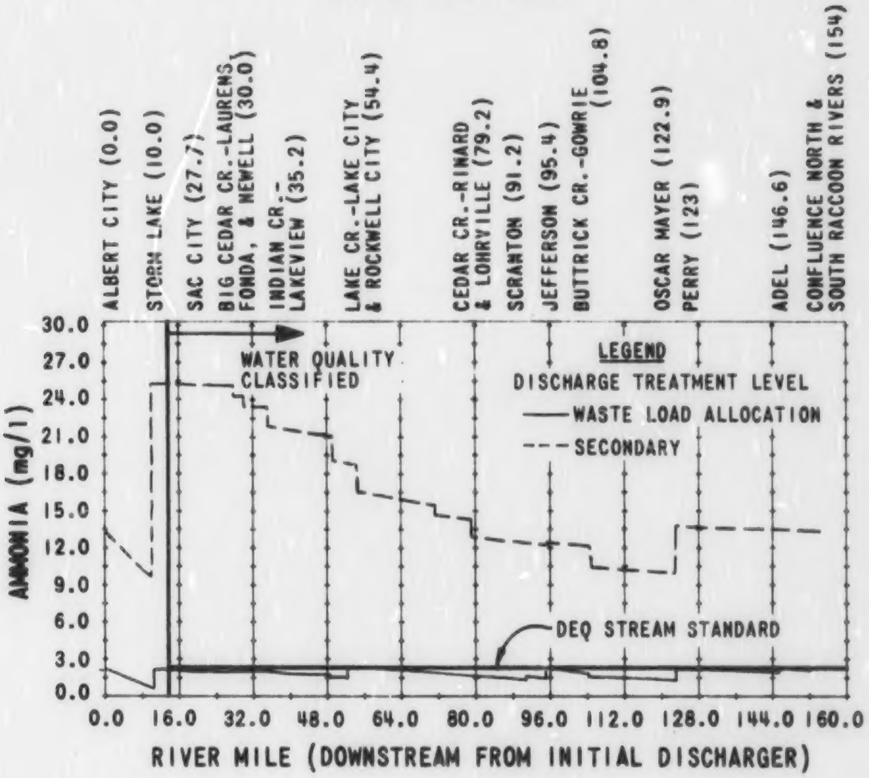


SOUTH RACCOON RIVER

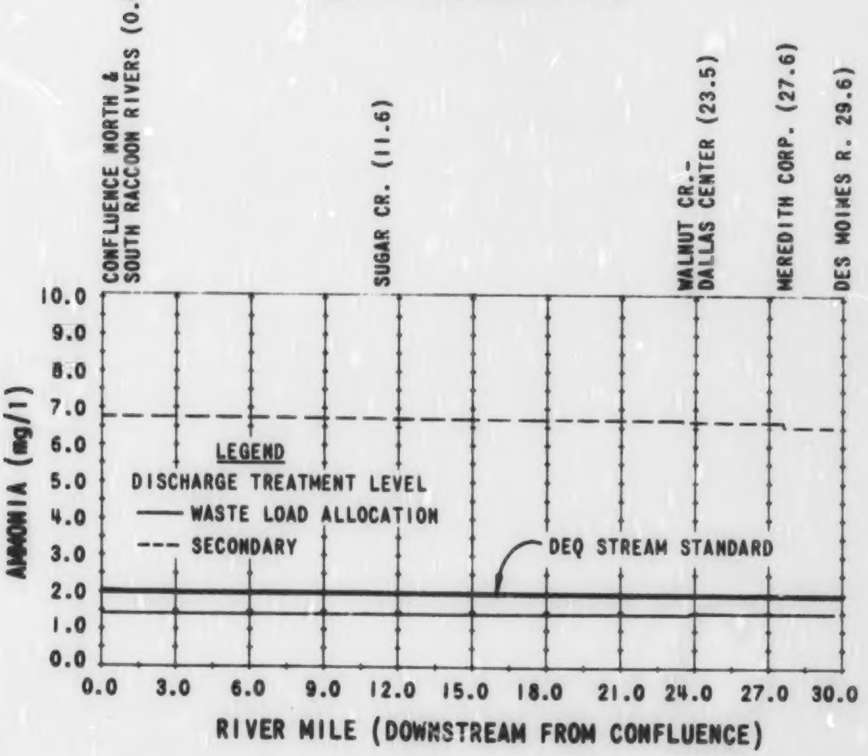


MIDDLE RACCOON RIVER

FIGURE VI-18
AMMONIA NITROGEN CONCENTRATIONS
WINTER CONDITIONS



NORTH RACCOON RIVER



RACCOON RIVER

Lower Des Moines River (below Saylorville Dam)

Summer Conditions - Dissolved oxygen and ammonia nitrogen concentration profiles for the Des Moines River, Beaver Creek, and the Middle River are shown on Figures VI-19, VI-20, and VI-21.

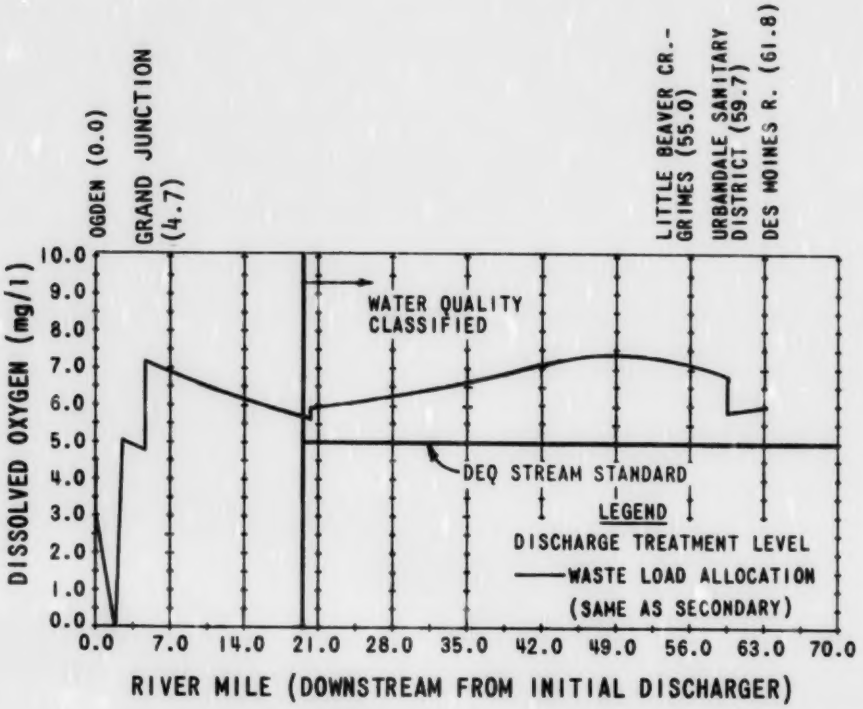
Secondary treatment or BPT is sufficient to meet the water quality criteria for dissolved oxygen and ammonia nitrogen with the exception of the cities of Des Moines, Grimes, Winterset, and Indianola (north plant) and the Urbandale Sanitary District which must provide both BOD and ammonia removal exceeding that of secondary treatment.

Winter Conditions - Dissolved oxygen and ammonia nitrogen concentration profiles for the Des Moines River, Beaver Creek, and the Middle River are shown on Figures VI-22, VI-23, and VI-24. Secondary treatment or BPT is sufficient to meet the water quality criteria for dissolved oxygen and ammonia nitrogen with the following exceptions: the cities of Grimes, Winterset, and Indianola (north plant) and the Urbandale Sanitary District must provide both BOD and ammonia nitrogen removal exceeding that of secondary treatment while Des Moines must provide only higher level ammonia nitrogen removal.

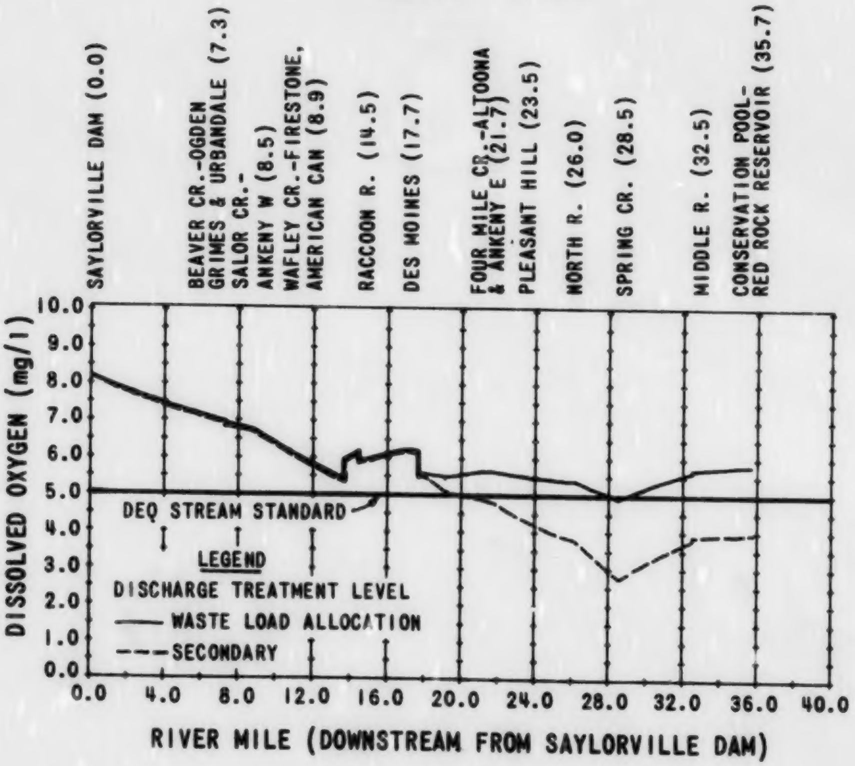
Special Note

Grimes and Urbandale were modeled at the seven-day ten-year low flow (7Q10). However, at 7Q10 the upper Beaver Creek is a dry run. Therefore, the Beaver Creek was also modeled at higher flow where the discharges from Ogden and Grand Junction reach the mouth of the creek. Figures VI-19, VI-20, VI-22, and VI-23 show this higher flow.

FIGURE VI-19
DISSOLVED OXYGEN CONCENTRATIONS
SUMMER CONDITIONS

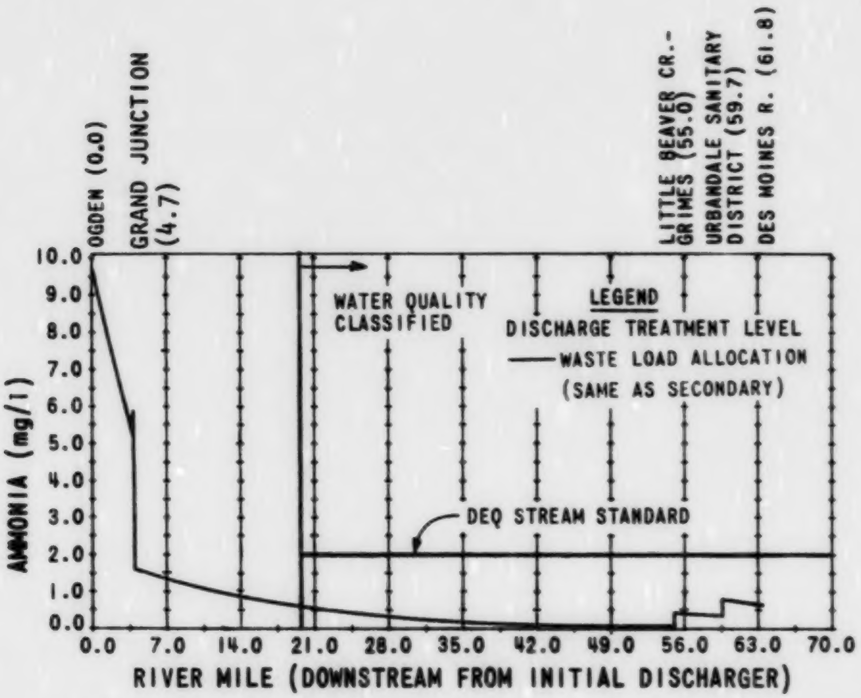


BEAVER CREEK

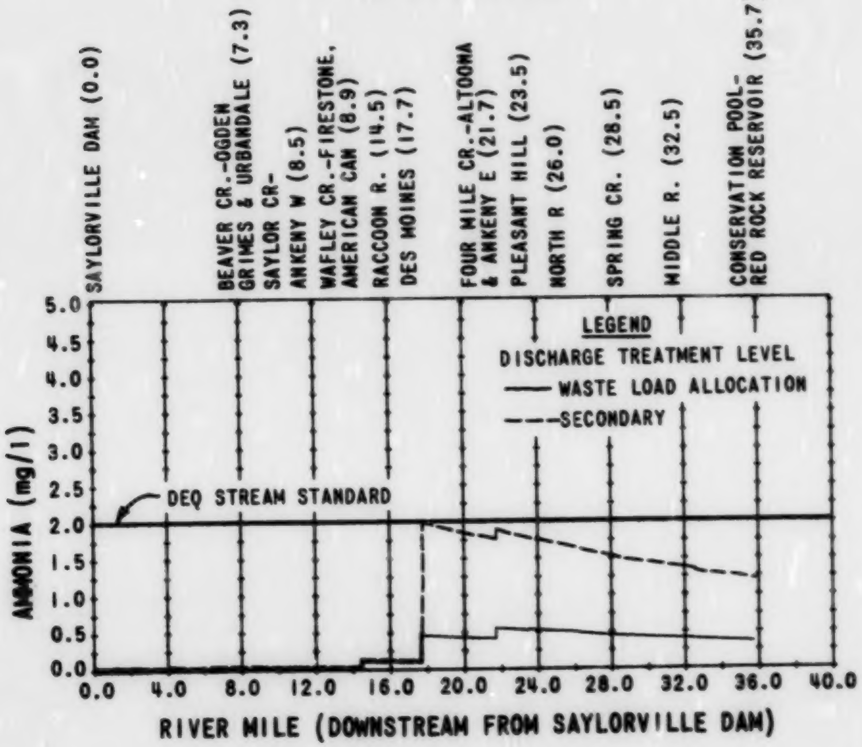


DES MOINES RIVER

FIGURE VI-20
AMMONIA NITROGEN CONCENTRATIONS
SUMMER CONDITIONS



BEAVER CREEK



DES MOINES RIVER

FIGURE VI - 21
DISSOLVED OXYGEN AND AMMONIA NITROGEN
CONCENTRATIONS
SUMMER CONDITIONS

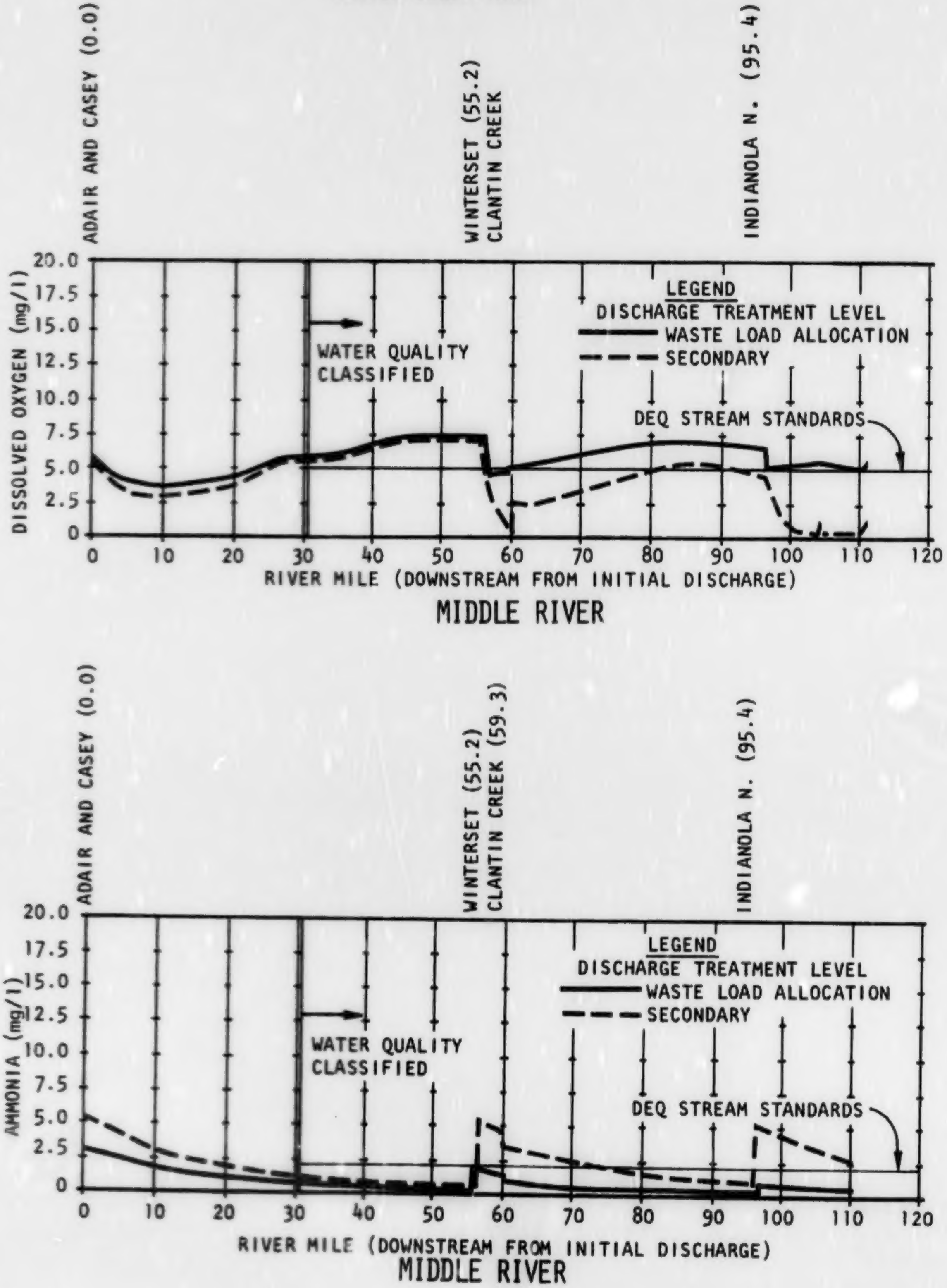
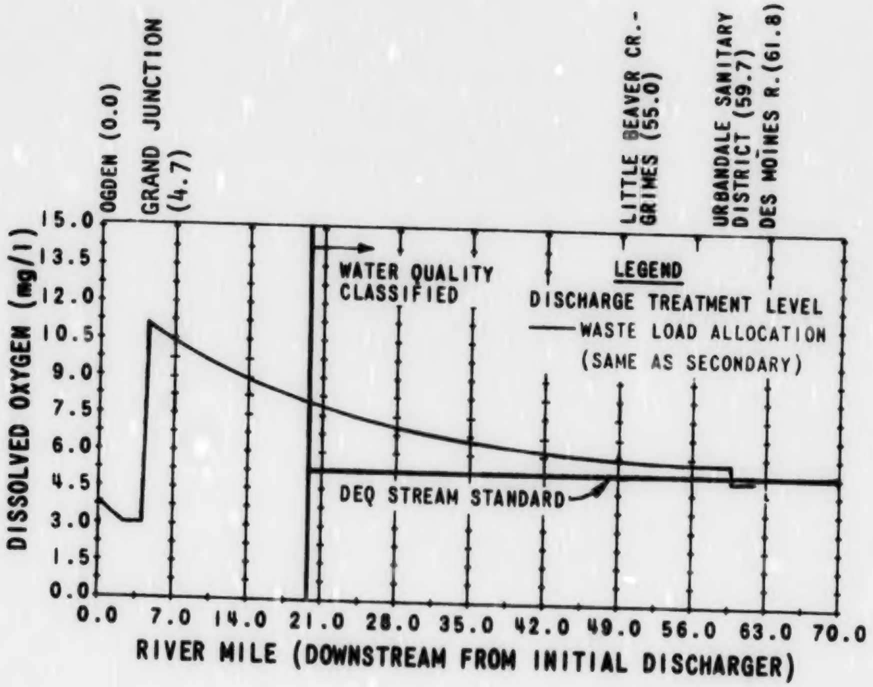
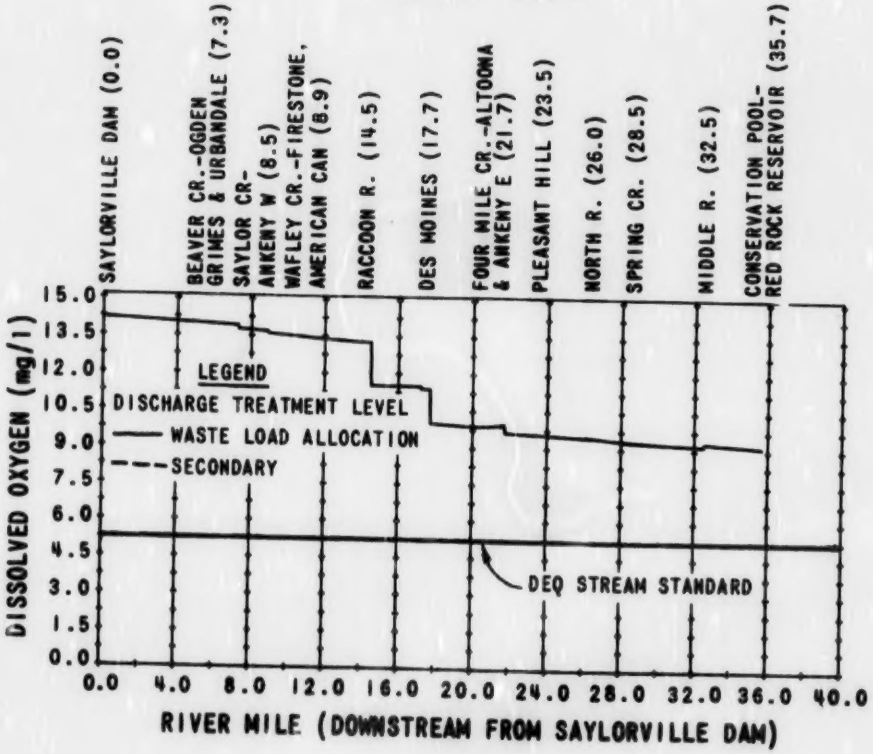


FIGURE VI-22
DISSOLVED OXYGEN CONCENTRATIONS
WINTER CONDITIONS

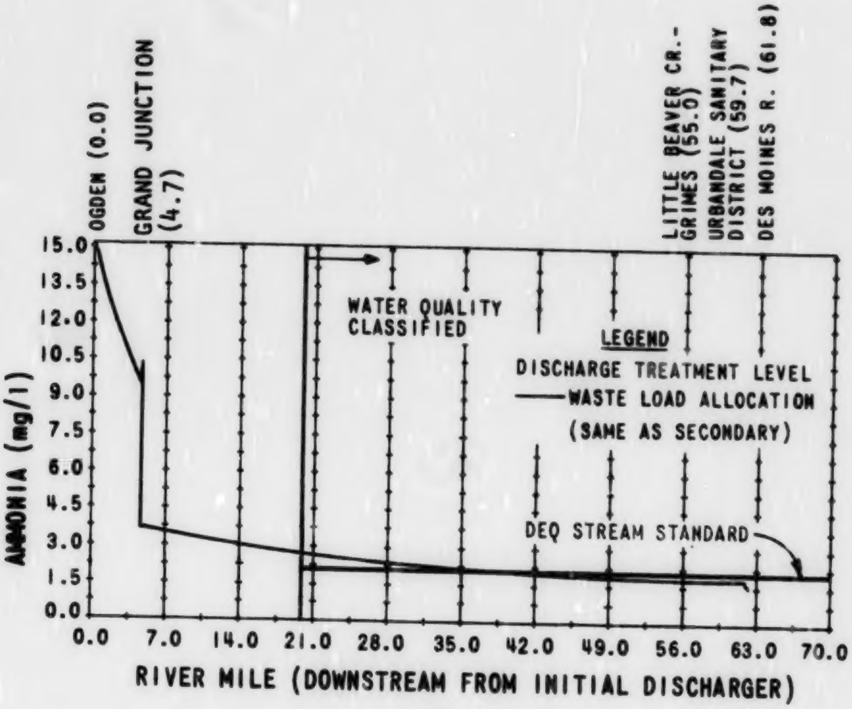


BEAVER CREEK

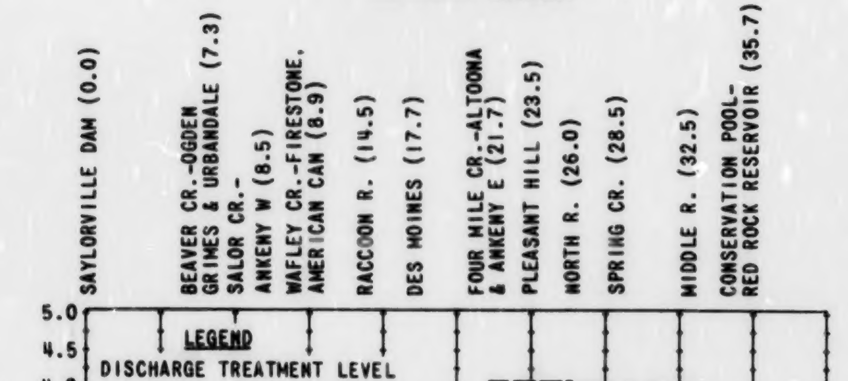


DES MOINES RIVER

FIGURE VI-23
AMMONIA NITROGEN CONCENTRATIONS
WINTER CONDITIONS

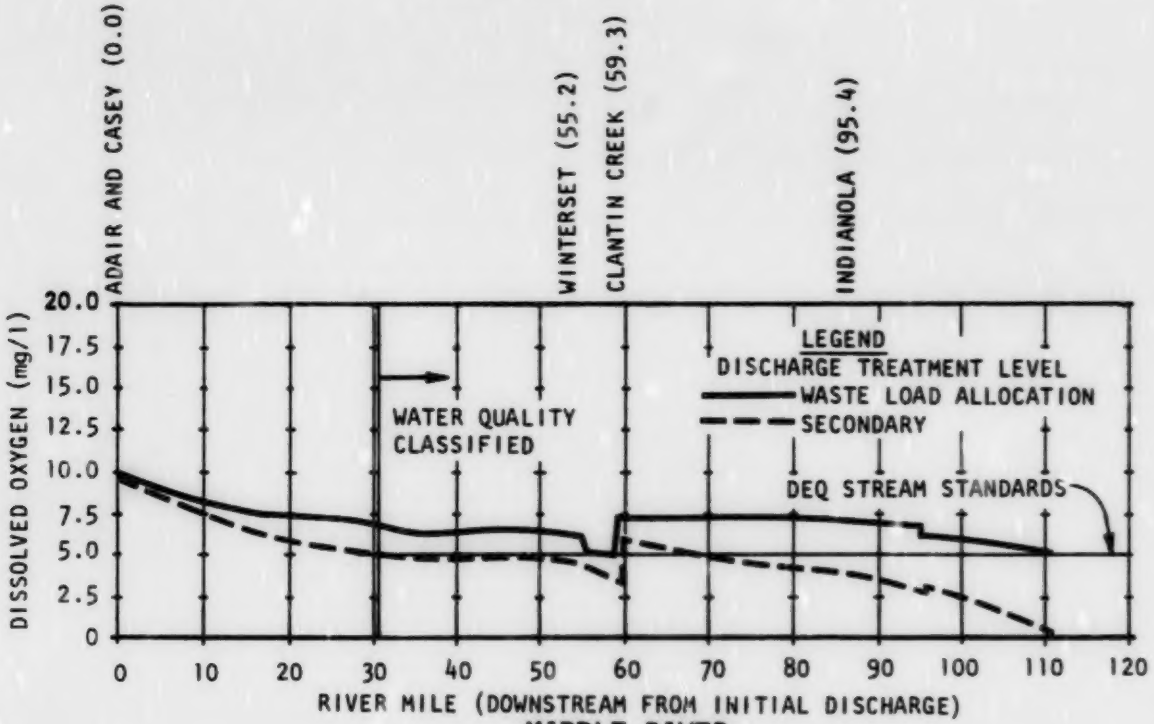


BEAVER CREEK

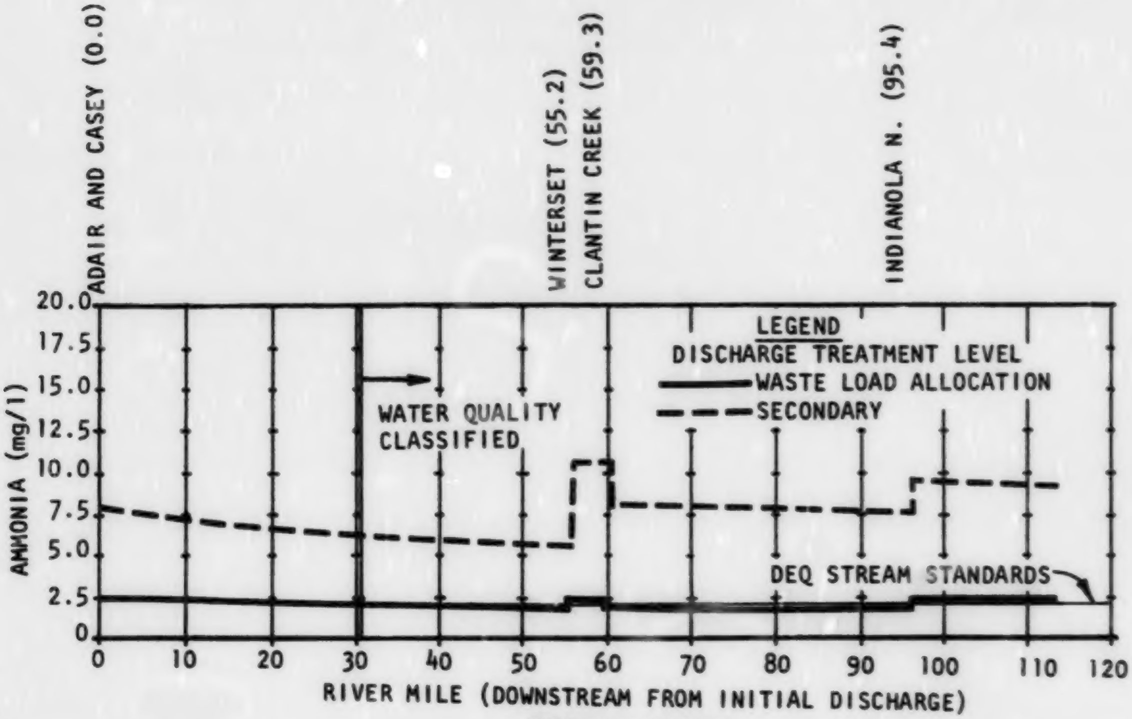


DES MOINES RIVER

FIGURE VI - 24
DISSOLVED OXYGEN AND AMMONIA NITROGEN
CONCENTRATIONS
WINTER CONDITIONS



MIDDLE RIVER



MIDDLE RIVER

SEGMENT CLASSIFICATION

From the waste load allocation analyses a classification of stream segments is possible. Segment classification is a contributing factor in the determination of the segment ranking, discharger ranking, and compliance scheduling. The two segment types are described as follows:

1. An effluent limited (EL) segment is any segment whose water quality is meeting and will continue to meet standards, or where there is adequate demonstration that standards will be met after application of secondary treatment or BPT to all point discharges to the segment.
2. A water quality limited (WQ) segment is the segment whose water quality does not currently meet applicable standards, and is not expected to meet standards even after application of secondary treatment or BPT to all point discharges to the segment.

The classification of the stream segments in the Des Moines River Basin are listed in Table VI-2. The water quality limited segments are shown in Figures VI-25, VI-26 and VI-27. All segments which are not designated as water quality limited are currently considered to be effluent limited.

DES MOINES BASIN
STREAM SEGMENT RANKING

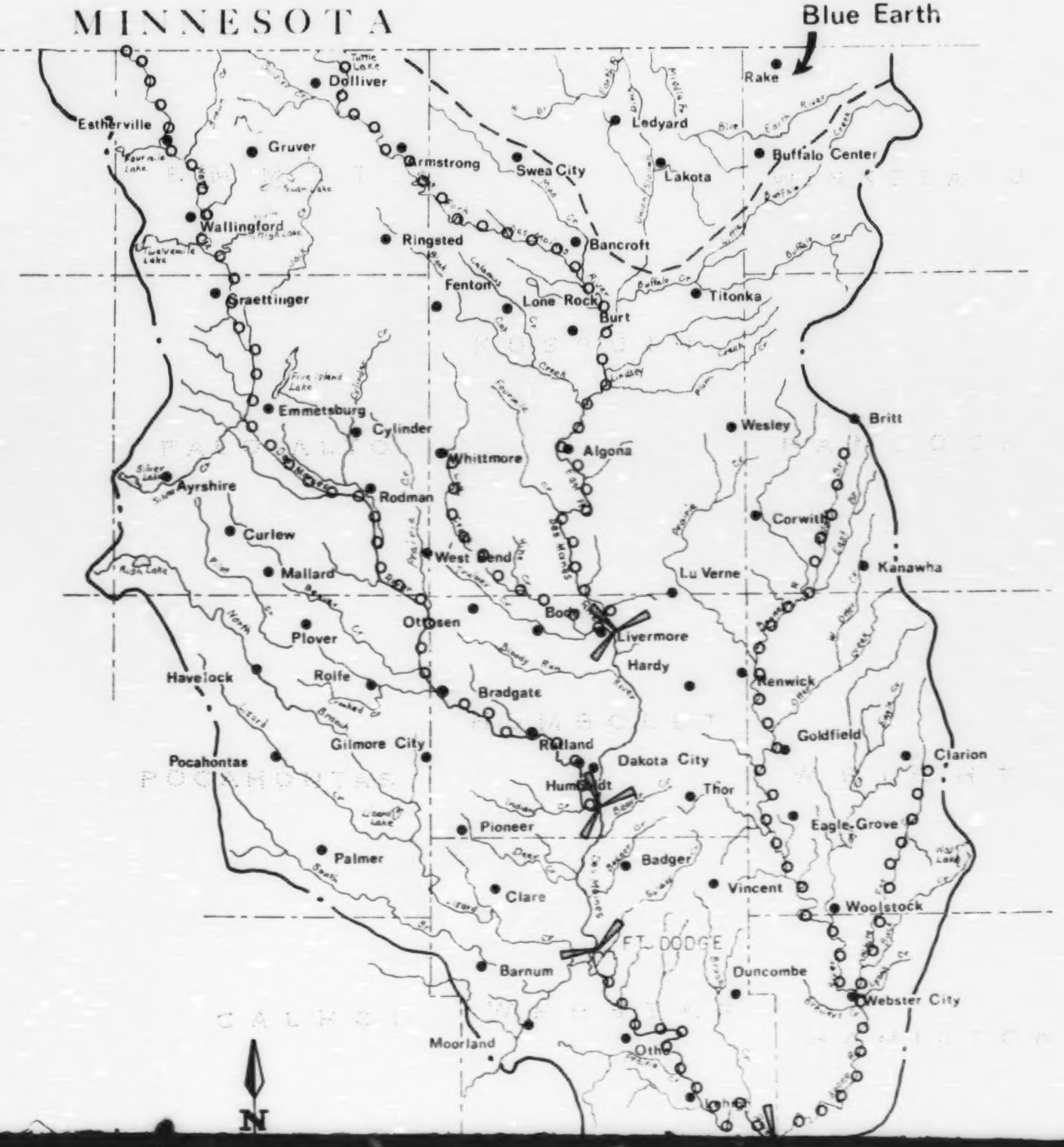
RANK	RIVER	STREAM SEGMENT	WQ/ EL*	A	B_C	B_W	C	BC	AES	POP	SQ	TOTAL POINTS	PRIORITY POINTS
				PRIORITY CRITERIA									
1	Des Moines River	Raccoon River to Red Rock Dam	WQ	2	0	1	0	1	1	2.0	4.0	30.00	29
2	Des Moines River	Boone R. to Saylorville Dam	WQ	2	0	1	0	1	1	1.5	4.0	28.00	28
3	Middle Raccoon R.	South Carroll County Line to South Fork Confluence	EL	2	0	1	2	1	1	1.0	3.0	25.50	27
4	Des Moines River	Red Rock Dam to Ottumwa	EL	2	0	1	2	1	0	2.0	2.5	21.25	26
5	Boone River	(entire length)	WQ	0	0	1	0	1	0	1.5	5.0	20.00	25
6	Lower Raccoon R.	North Fork to Des Moines R.	EL	0	0	1	2	1	0	2.0	3.0	19.50	24
7	Des Moines River	E. and W. Fork to Ft. Dodge	EL	2	0	1	0	1	0	2.0	3.0	19.50	23
8	Des Moines River	Ft. Dodge to Boone River	WQ	0	0	1	0	1	0	2.0	4.0	18.00	22
9	North Raccoon R.	Big Cedar Creek to Green-Carroll County Line	WQ	0	0	1	0	1	0	0.5	6.0	18.00	21
10	W.F. Des Moines R.	(entire length)	WQ	0	0	1	0	1	0	1.0	5.0	17.5	
11	North Raccoon R.	Above Big Cedar Creek	WQ	0	0	1	0	1	0	1.0	5.0	17.50	19
12	Des Moines River	Saylorville Dam to Raccoon R.	EL	2	0	1	0	1	0	2.0	2.5	16.25	18
13	Des Moines River	Ottumwa to Koekuk	EL	2	0	1	0	1	0	2.0	2.5	16.25	
14	North Raccoon R.	Greene - Carroll County Line to Main Stem Confluence	WQ	0	0	1	0	1	0	1.5	4.0	16.00	16

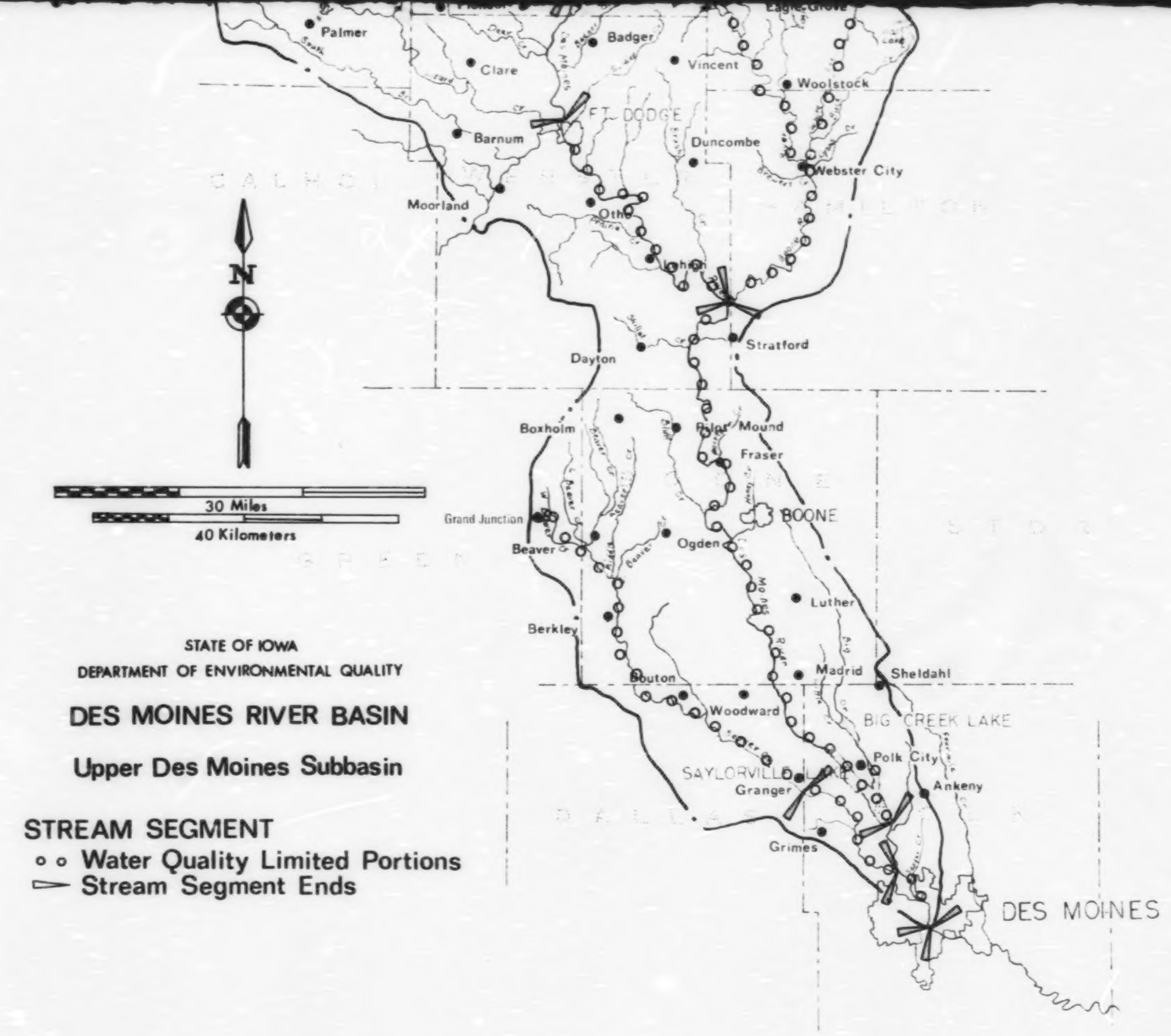
DES MOINES BASIN
STREAM SEGMENT RANKING

					PRIORITY CRITERIA								
RANK	RIVER	STREAM SEGMENT	WQ/ EL*	A	B_C	B_W	C	BC	AES	POP	SQ	TOTAL POINTS	PRIORITY POINTS
15	Middle River	(entire length)	WQ	0	0	1	0	1	0	1.5	4.0	16.00	15
16	Beaver Creek	Polk Co. Line to Des Moines R.	WQ	0	0	1	0	0	0	2.0	4.0	14.00	14
17	Middle Raccoon R.	Above S. Carroll County Line	WQ	0	0	1	0	1	0	1.0	4.0	14.00	13
18	E.F. Des Moines R.	Above Lotts Creek	WQ	0	0	1	0	1	0	1.0	4.0	14.00	12
19	Big Cedar Creek	(North Raccoon River)	WQ	0	0	0	0	1	0	1.0	5.0	12.50	11
20	E.F. Des Moines R.	Lotts Creek to Confluence	EL	0	0	1	0	1	0	1.0	3.0	10.50	10
21	South Raccoon R.	S&M Fork Confluence to N.Fork	EL	0	0	1	0	1	0	1.0	3.0	10.50	9
22	Lotts Creek	(entire length)	WQ	0	0	1	0	0	0	0.5	4.0	8.00	8
23	South Raccoon R.	Above S&M Fork Confluence	EL	0	0	1	0	1	0	0.5	2.5	7.50	7
24	Sugar Creek	(entire length)	WQ	0	0	1	0	0	0	0.0	4.0	6.00	6
25	Beaver Creek	Above Polk County Line	WQ	0	0	0	0	0	0	0.0	4.0	2.00	5
26	North River	(entire length)	EL	0	0	0	0	0	0	0.0	2.5	1.25	4
27	South River	(entire length)	EL	0	0	0	0	0	0	0.0	2.5	1.25	3
28	White Breast Cr.	(entire length)	EL	0	0	0	0	0	0	0.0	2.5	1.25	2
29	Blue Earth River	(entire length)	EL	0	0	0	0	0	0	0.0	2.5	1.25	1

*Water Quality or Effluent Limited

A

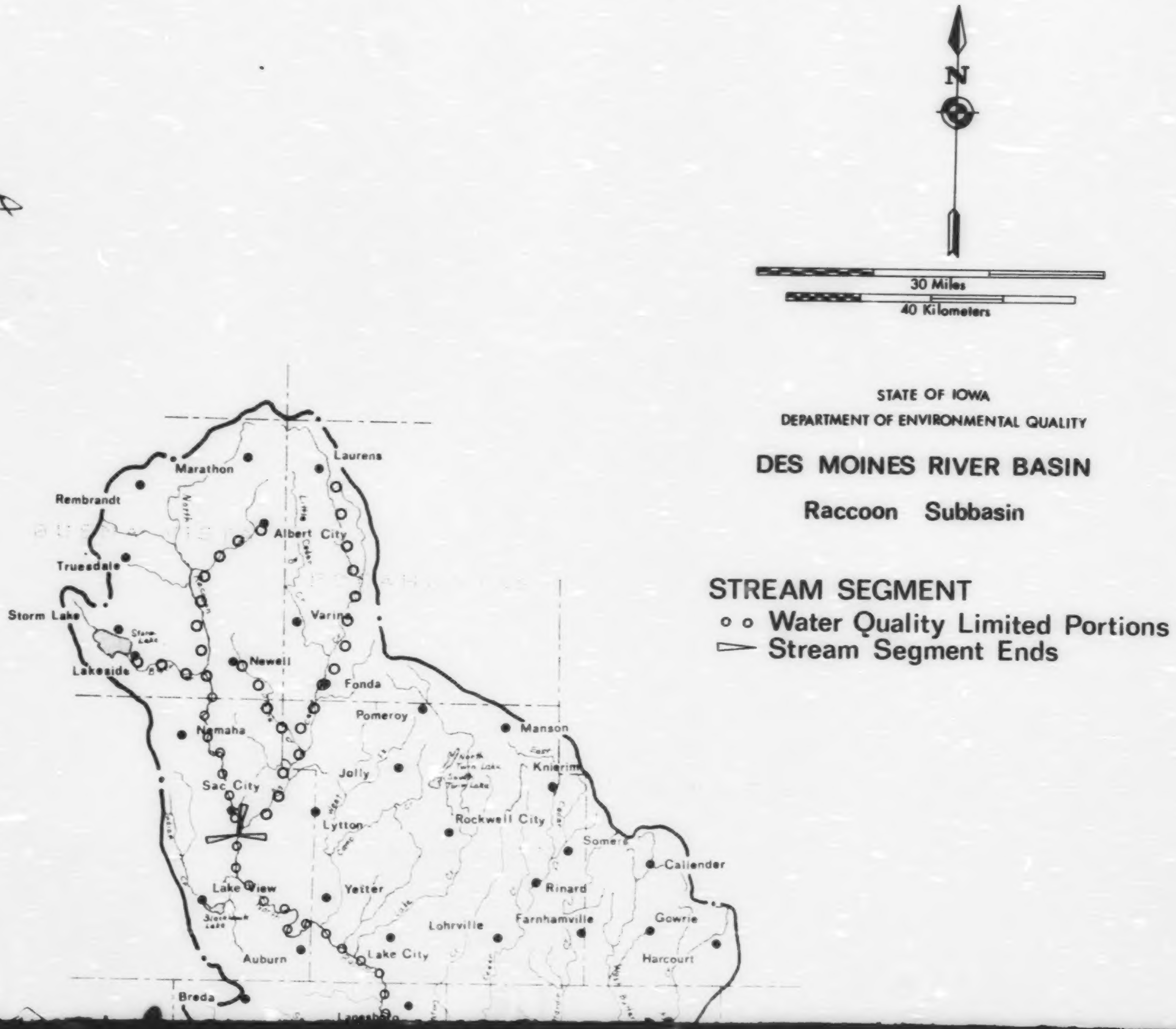

MINNESOTA
Blue Earth
Rake
Estherville
Dolliver
Tuttle Lake
Gruver
Armstrong
Swea City
Ledyard
Lakota
Buffalo Center
Wallingford
Ringsted
Bancroft
Fenton
Lone Rock
Burt
Titonka
Graettinger
Emmetsburg
Cylinder
Five Island Lake
Whittmore
Algona
Wesley
Britt
Ayrshire
Silver Lake
Rodman
Curlew
Mallard
West Bend
Corwith
Kanawha
Lu Verne
Ottosen
Bode
Livermore
Plover
Havelock
Rolfe
Hardy
Renwick
Bradgate
Rutland
Goldfield
Pocahontas
Gilmore City
Dakota City
Humboldt
Thor
Clarion
Pioneer
Eagle Grove
Palmer
Badger
Vincent
Clare
Woolstock
FT. DODGE
Barnum
Duncombe
Webster City
Moorland
Otho
Lehigh
Des Moines
N


Palmer
Clare
Badger
Vincent
Eagle Grove
Woolstock
FT. DODGE
Barnum
Duncombe
Webster City
Moorland
Otho
Lehigh
Dayton
Stratford
Boxholm
Pilot Mound
Fraser
BOONE
Grand Junction
Beaver
Ogden
Luther
Berkley
Madrid
Sheldahl
Bouton
Woodward
BIG CREEK LAKE
SAYLORVILLE LAKE
Polk City
Granger
Ankeny
Grimes
DES MOINES
Des Moines River
N
30 Miles
40 Kilometers
STATE OF IOWA
DEPARTMENT OF ENVIRONMENTAL QUALITY
DES MOINES RIVER BASIN
Upper Des Moines Subbasin
STREAM SEGMENT
o o Water Quality Limited Portions
Stream Segment Ends

B

FIGURE VI-25

A


N
30 Miles
40 Kilometers
Laurens
Marathon
Rembrandt
Albert City
Truesdale
Storm Lake
Storm Lake
Lakeside
Varina
Newell
Fonda
Pomeroy
Manson
Nemaha
Jolly
Knierim
Sac City
Lytton
Rockwell City
Somers
Callender
Lake View
Yetter
Rinard
Lohrville
Farnhamville
Gowrie
Auburn
Lake City
Harcourt
Breda
Lanesboro
North
Little Cedar

STATE OF IOWA

DEPARTMENT OF ENVIRONMENTAL QUALITY

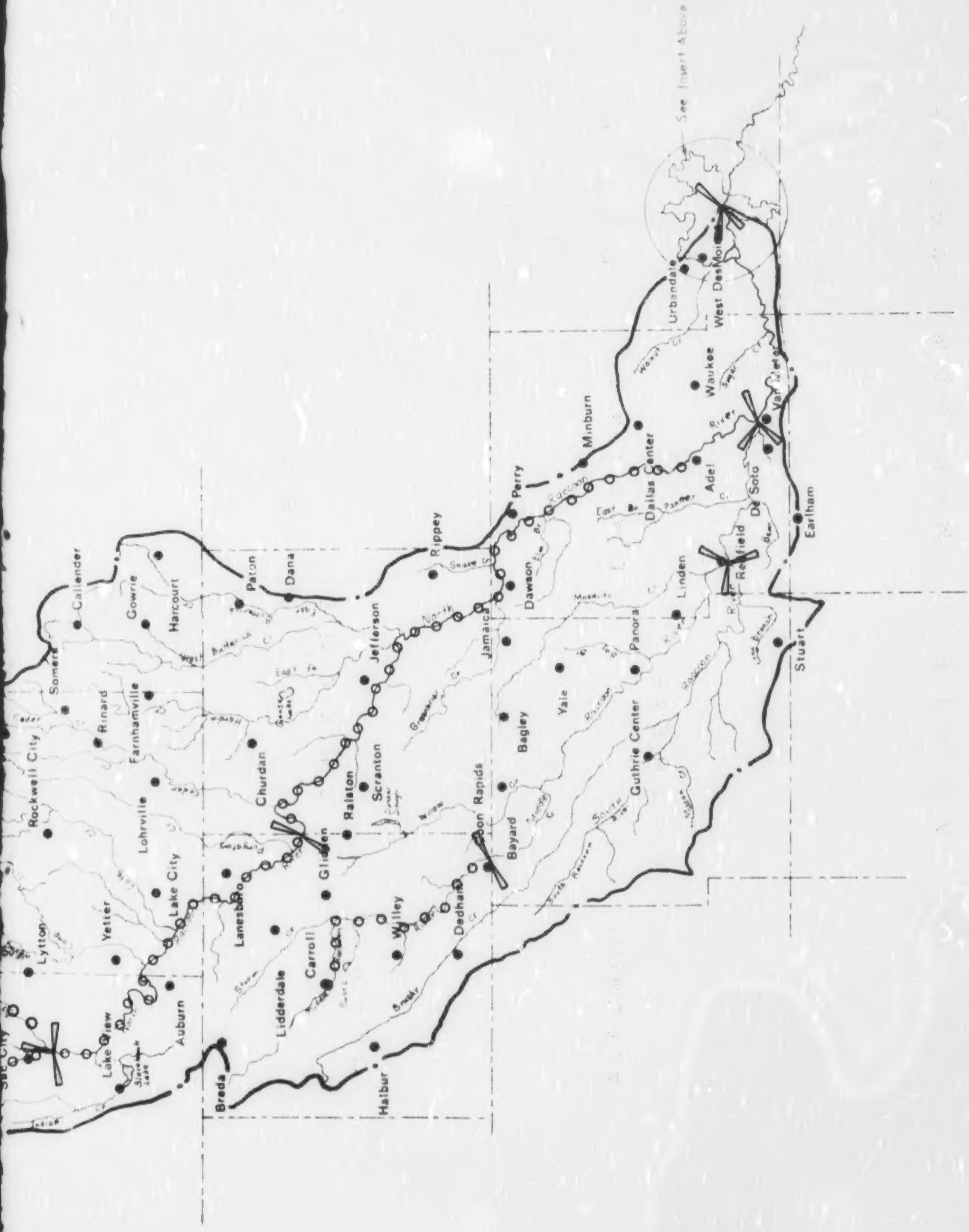
DES MOINES RIVER BASIN

Raccoon Subbasin

STREAM SEGMENT

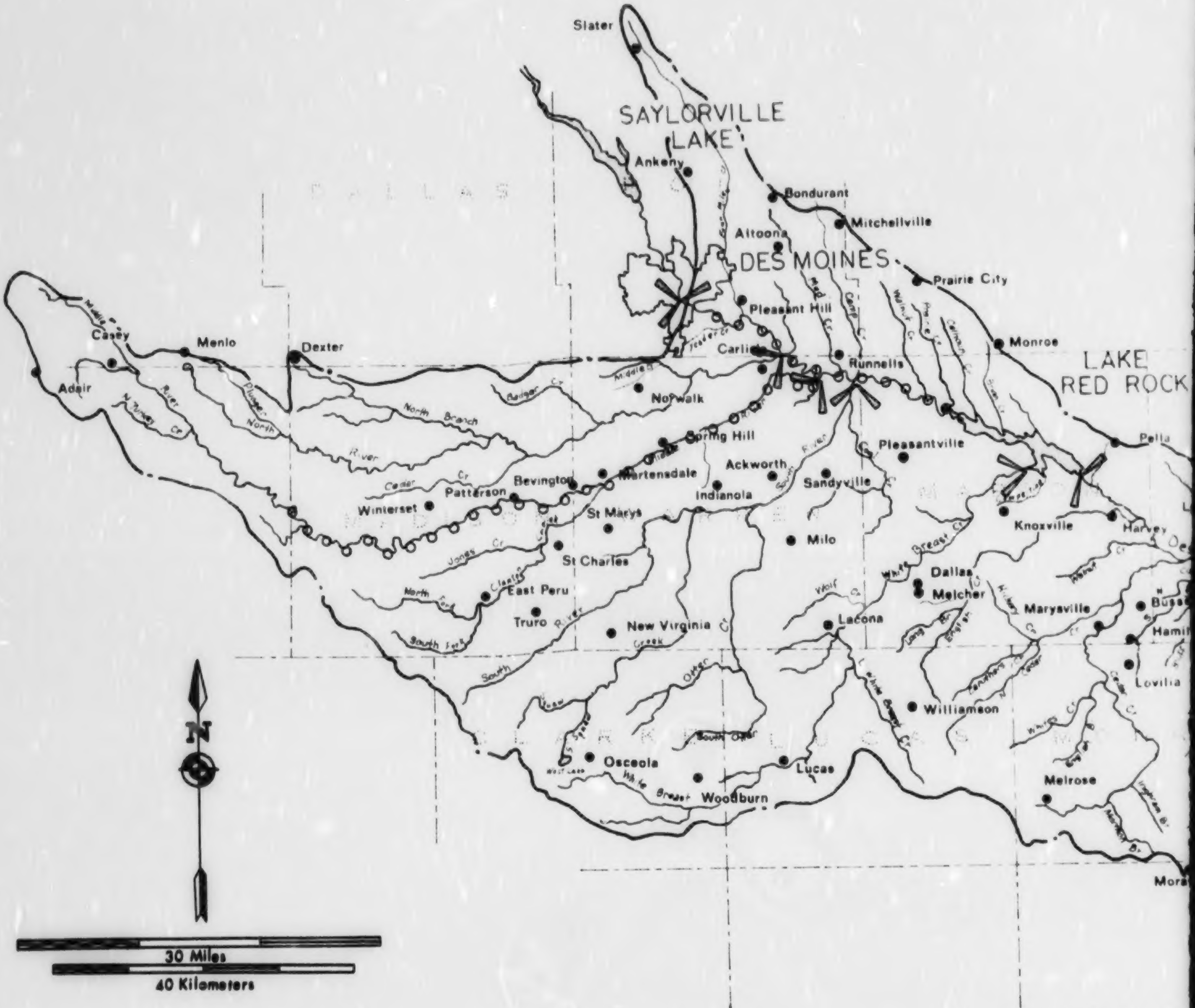
○ ○ Water Quality Limited Portions

▷ Stream Segment Ends


See Insert Above
Urbandale
West Des Moines
Waukee
Van Meter
Minburn
Dallas Center
Adel
De Soto
Earlham
Redfield
Linden
Perry
Rippey
Dawson
Paton
Dana
Callender
Gowrie
Harcourt
Jamaica
Jefferson
Panora
Stuart
Yale
Bagley
Guthrie Center
Scranton
Ralston
Churdan
Somers
Rinard
Farnhamville
Rockwell City
Lohrville
Lake City
Glidden
Coon Rapids
Bayard
Lanesboro
Carroll
Willey
Dedham
Yetter
Lytton
Lake View
Auburn
Lidderdale
Breda
Halbur
Raccoon
North
South
River
East Br.
Panther Cr.
Sugar Cr.
Walnut Cr.
Snake Cr.
Elm Br.
Mosquito
West Buttrick Cr.
East Fk.
Willow
Middle
South Raccoon
Brushy
Indian Cr.
Cedar
Storm Lake

B

FIGURE VI-26


Slater
SAYLORVILLE LAKE
Ankeny
Bondurant
Mitchellville
Altoona
DES MOINES
Prairie City
Pleasant Hill
Monroe
LAKE RED ROCK
Casey
Menlo
Dexter
Adair
Carlisle
Runnells
Norwalk
Spring Hill
Pleasantville
Pella
Ackworth
Martensdale
Bevington
Indianola
Sandyville
Winterset
Patterson
St Marys
Knoxville
Harvey
Milo
St Charles
Dallas
Melcher
East Peru
Truro
Marysville
New Virginia
Lacona
Williamson
Lovilia
Osceola
Lucas
Woodburn
Melrose
DALLAS
MADISON
WARREN
MARION
CLARKE
LUCAS
N
30 Miles
40 Kilometers

STATE OF IOWA
DEPARTMENT OF ENVIRONMENTAL QUALITY

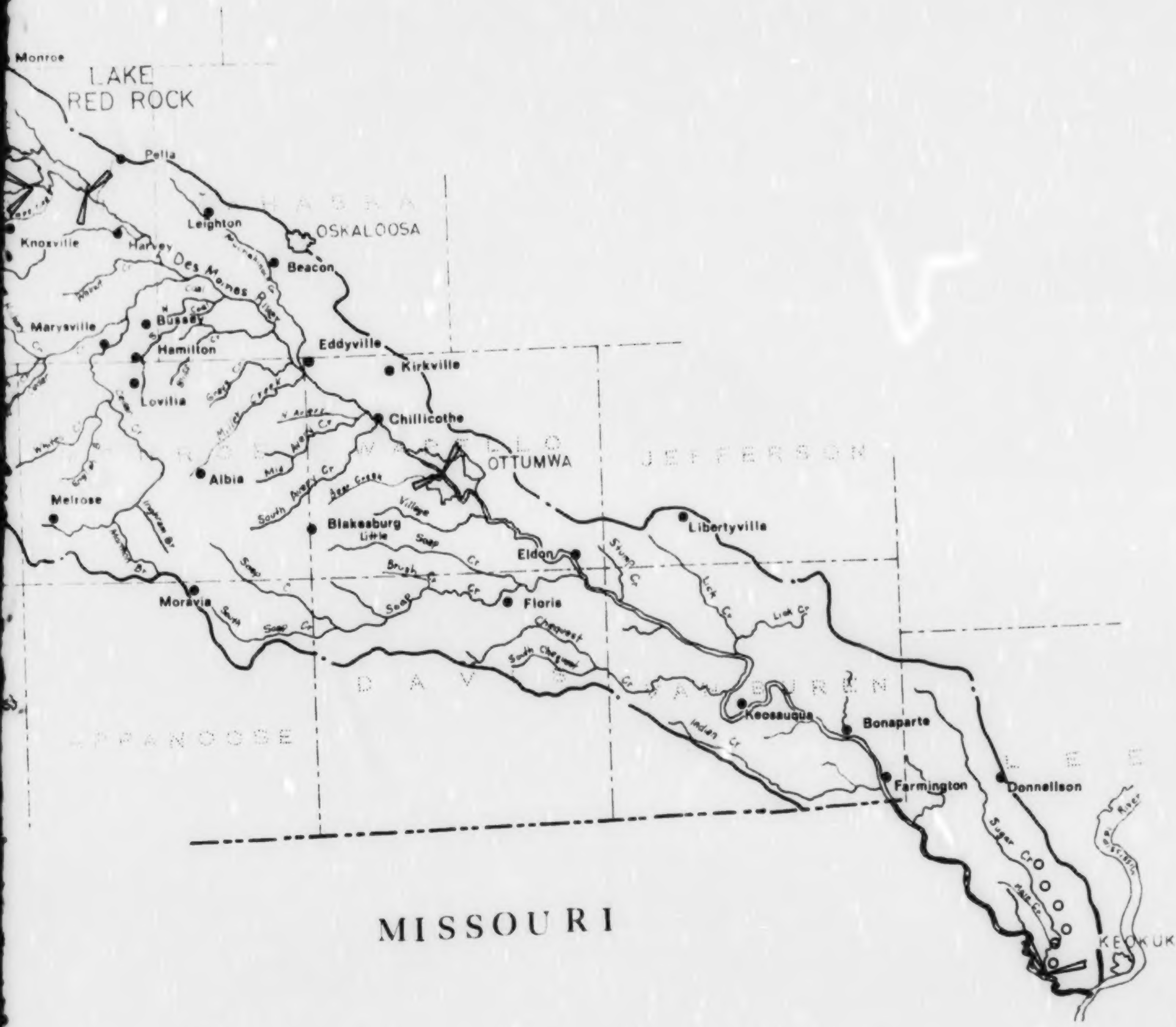
DES MOINES RIVER BASIN

Lower Des Moines Subbasin

STREAM SEGMENT

- ○ ○ Water Quality Limited Portions
- ▷ Stream Segment Ends

A


Monroe
LAKE RED ROCK
Pella
MAHASKA
Leighton
OSKALOOSA
Knoxville
Harvey
Des Moines River
Beacon
Marysville
Bussey
Hamilton
Eddyville
Kirkville
Lovilia
Chillicothe
MONROE
WAPELLO
OTTUMWA
JEFFERSON
Albia
Melrose
Blakesburg
Libertyville
Eldon
Moravia
Floris
DAVIS
VAN BUREN
Keosauqua
Bonaparte
APPANOOSE
Farmington
Donnellson
LEE
Sugar Cr
KEOKUK
MISSOURI

B

FIGURE VI-27

PRIORITY RANKINGS

Stream Segment Ranking

The Des Moines River Basin has been divided into various stream segments. Each stream segment consists of surface waters that have common hydrologic characteristics and natural, physical, chemical, and biological processes. The segments have been ranked in order of abatement priority. The ranking methodology has attempted to take into account: (1) severity of pollution problems, (2) population affected, (3) need for preservation of high quality waters, and (4) national priorities.

The total points for a segment are determined from a product of the points earned in each of two factors. The formula weighs both the degree of usefulness of a segment and the severity of the pollution problem. The specific details and rationale used for the segment ranking methodology have been described in Chapter I.

Table VI-2 lists the stream segments selected, their respective priority points, and their final ranking. Figures VI-25 VI-26, and VI-27 show the stream segments.

Table VI-3 lists the reductions in waste load that can be achieved by the waste load allocations.

Municipal Discharger Ranking Methodology

The significant municipal dischargers in the basin have been ranked to be consistent with the segment priority ranking and

TABLE VI-3

WASTE LOAD REDUCTIONS

Dischargers	Reference Number	Present Flow (mgd)	Present lbs.Eff. BOD_5/NH_3	Projected (1990) Flow (mgd)	Projected (1990) lbs.Eff. BOD_5/NH_3	Load Reduction BOD/NH_3
Blue Earth River						
Ledyard	M- 1	NEMTF	----	0.024	6/3	4/
Lakota	M- 2	NEMTF	----	0.04	10/5	4/
Buffalo Center	M- 3	0.100	P.S.	C.D.		
Rake	M- 4	NEMTF	----	0.032	8/4	4/
Segment Total					24/12	4/
West Fork Des Moines River						
Estherville	M- 5	.025	2280/557	2.51	209/42	2071/515
Gruver	M- 6	NEMTF	----	C.D.	C.D.	
Wallingford	M- 7	NEMTF	----	C.D.	C.D.	
Graettinger	M- 8	0.185	P.S.	C.D.	C.D.	
Emmetsburg	M- 9	0.222	74/28	0.55	45/9	29/19
Ayrshire	M-10	NEMTF	----	C.D.	C.D.	
Cylinder	M-11	NEMTF	----	C.D.	C.D.	
Rodman	M-12	NEMTF	----	----	----	
West Bend	M-13	0.077	35/7	0.076	19/10	16/-- 4/
Curlew	M-14	NEMTF	----	----	----	
Mallard	M-15	NA	----	.0384	C.D.	
Polver	M-16	NEMTF	----	----	----	
Rolfe	M-17	0.032	P.S.	C.D.	C.D.	
Bradgate	M-18	NEMTF	----	----	----	
Rutland	M-19	NEMTF	----	C.D.	C.D.	4/
Humboldt	M-20	0.683	114/46	0.926	232/54	4/
Segment Total			2503/638		505/115	2116/534
East Fork Des Moines River						
Armstrong	M-21	0.089	P.S.	C.D.	C.D.	
Dolliver	M-22	NEMTF	----	----	----	
Swea City	M-23	0.047	P.S.	C.D.	C.D.	
Bancroft	M-24	0.099	66/18	C.D.	C.D.	66/18
Burt	M-25	0.157	P.S.	C.D.	C.D.	
Titonka	M-26	0.056	P.S.	C.D.	C.D.	
Ringsted	M-27	0.043	P.S.	C.D.	C.D.	
Fenton	M-28	NEMTF	----	C.D.	C.D.	
Lone Rock	M-29	NEMTF	----	----	----	4/
Algona	M-30	0.552	184/37	0.900	225/45	4/
Livermore	M-31	0.033	P.S.	C.D.	C.D.	
Segment Total			250/55		225/45	66/18

TABLE VI-3 CONTINUED

Dischargers	Reference Number	Present		Projected (1990)		Load Reduction
		Flow (mgd)	lbs.Eff. BOD_5/NH_3	Flow (mgd)	lbs.Eff. BOD_5/NH_3	BOD/NH_3
Lotts Creek						
Whittemore	M-32	0.251	157/4	0.150	38/3	119/1
Bode	M-33	0.017	P.S.	C.D.	C.D.	
Segment Total			157/4		38/3	119/1
East Fork Des Moines River						
Ottosen	M-34	NEMTF	----	----	----	
Hardy	M-35	NEMTF	----	----	----	
Dakota City	M-36	0.044	13/4	0.042	11/5	2/--4/
Segment Total			13/4		11/5	2/--4/
Des Moines River						
Pocahontas	M-40	0.236	79/12	0.324	81/41	4/
Havelock	M-39	NEMTF	----	.0262	7/4	4/
Gilmore City	M-41	0.087	P.S.	C.D.	C.D.	
Clare	M-42	NA	P.S.	C.D.	C.D.	
Palmer	M-225	NEMTF	----	0.028	7/4	4/
Barnum	M-43	NEMTF	----	C.D.	C.D.	
Moorland	M-44	NEMTF	----	.032	8/4	4/
Segment Total			79/12		103/53	4/
Des Moines River						
Fort Dodge	M-45	3.367	1067/421	4.322	1081/144	--4//277
Ia. Beef Proc.	I-25	1.00	1580/900	NA	C.D.	1580/900
Savage S.D.	M-46	C.D.	NA	C.D.	C.D.	
Otho	M-47	0.057	P.S.	C.D.	C.D.	
Farmland Ind.	I-31	0.60	50/88	NA	C.D.	50/88
Leigh	M-48	0.047	P.S.	C.D.	C.D.	
Vincent	M-49	C.D.	P.S.	C.D.	C.D.	
Duncombe	M-50	0.022	P.S.	C.D.	C.D.	
Segment Total			2697/409		1081/144	1630/1265

TABLE VI-3 CONTINUED

Dischargers	Reference Number	Present Flow (mgd)	Present lbs.Eff. BOD_5/NH_3	Projected (1990) Flow (mgd)	Projected (1990) lbs.Eff. BOD_5/NH_3	Load Reduction BOD/NH_3
Boone River						
Corwith	M-51	0.023	P.S.	C.D.	C.D	
Britt	M-52	0.242	80/4	0.230	58/4	22/0
Wesley	M-53	NEMTF	----	C.D.	C.D.	
Luverne	M-54	C.D.	----	C.D.	C.D.	
Renwick	M-55	0.076	P.S.	C.D.	C.D.	
Kanawha	M-56	0.083	P.S.	C.D.	C.D.	
Goldfield	M-57	0.024	P.S.	C.D.	C.D.	
Thor	M-58	NEMTF	----	C.D.	C.D.	
Eagle Grove	M-59	0.682	283/109	9.560	140/9	143/100
Clarion	M-60	0.261	131/35	0.208	70/5	61/30
Woolstock	M-61	NEMTF	----	C.D.	C.D.	
Webster City	M-62	1.582	330/198	2.06	515/34	--[4/]/164
Segment Total			824/346		783/52	226/294
Des Moines River						
Stratford	M-63	0.060	13/5	0.070	18/9	[4/]
Dayton	M-64	0.150	50.8	0.174	44/22	6/--[4/]
Fraser	M-65	NEMTF	----	----	----	
Boxholm	M-66	NEMTF	----	C.D.	C.D.	
Pilot Mound	M-76	NEMTF	----	C.D.	C.D.	
Boone	M-68	1.99	697/199	2.407	602/100	95/99
Luther	M-69	NEMTF	----	----	----	
Madrid	M-70	0.198	58/21	0.004	65/32	[4/]
Plains Poultry	I-41	0.01	9/--	NA	3/--	6/--
Polk City	M-71	0.070	P.S.	C.D.	C.D.	
Ankeny Ind.	M-154-2	--To Be Included in M-154-1 Needs--				
Segment Total			827/233		732/163	107/99
Beaver Creek						
Beaver	M-72	NEMTF	----	----	----	
Grand Junction	M-117	0.040	12/1	0.040	10/2	2/--[4/]
Ogden	M-73	0.342	100/34	.176	44/22	56/12
Berkley	M-74	NEMTF	----	----	----	
Woodward	M-75	0.084	P.S.	C.D.	C.D.	
Bouton	M-76	NEMTF	----	----	----	
Segment Total			112/35		54/24	58/12

TABLE VI-3 CONTINUED

Dischargers	Reference Number	Present Flow (mgd)	Present lbs.Eff. BOD_5/NH_3	Projected (1990) Flow (mgd)	Projected (1990) lbs.Eff. BOD_5/NH_3	Load Reduction BOD/NH_3
Beaver Creek						
Granger	M-77	0.060	P.S.	C.D.	C.D.	
Grimes	M-78	0.10	25/4	0.131	33/8	4/
Johnston	M-224	NEMTF	----	0.50	1/	
Urbandale S.D.	M-79	0.30	65/25*	0.875	1/	
Segment Total			90/29		33/8	57/21 2/
Des Moines River						
Ankeny W.	M-154-1	0.517	151/86	1.707	38/3 1/	
Segment Total			151/86		38/3 1/	113/83 2/
North Raccoon River						
Marathon	M-80	NEMTF	----	0.48	12/6	4/
Rembrandt	M-81	0.015	P.S.	C.D.	C.D.	
Albert City	M-82	0.080	25/7	0.085	12/6	4/1
Truesdale	M-83	NEMTF	----	----	----	4/
Storm Lake	M-84	1.516	506/164	3.090	773/51	--/348 4/
Storm Lake	M-85	1.046	218/235			
Hy-Grade		--To Be Included in Storm Lake 201 Plan--				
Lakeside	M-86	--To Be Included in Storm Lake 201 Plan--				
Nemaha	M-88	NEMTF	----	----	----	
Sac City	M-87	0.270	90/25	0.28	70/5	20/20
Segment Total			839/431		876/68	--/369
North Raccoon River Cedar Creek						
Laurens	M-89	0.160	53/17	0.160	40/3	13/14
Varina	M-90	NEMTF	----	----	----	
Fonda	M-91	NA	40/5	0.093	23/2	17/3
Newell	M-92	0.087	25/5	0.092	23/12	2/-- 4/
Segment Total			118/27		86/17	32/17

TABLE VI-3 CONTINUED

Dischargers	Reference Number	Present Flow (mgd)	Present lbs.Eff. BOD_5/NH_3	Projected (1990) Flow (mgd)	Projected (1990) lbs.Eff. BOD_5/NH_3	Load Reduction BOD/NH_3
North Raccoon River						
Lake View	M-93	0.218	45/18	0.229	57/8	--[4/]/10
Auburn	M-94	NEMTF	----	C.D.	C.D.	
Jolley	M-95	NEMTF	----	----	----	
Lytton	M-96	0.157	P.S.	C.D.	C.D.	
Yetter	M-97	NEMTF	----	----	----	
Pomeroy	M-98	0.073	P.S.	C.D.	C.D.	
Rockwell City	M-99	0.264	66/35	0.277	69/16	--[4/]/19
Lake City N.	M-100	0.090	23/8	0.095	24/6	--[4/]/2
Lake City S.W.	M-101	0.084	23/7	0.084	21/5	2/2
Lanesboro	M-102	NEMTF	----	C.D.	C.D.	
Segment Total			157/68		171/35	--[4/]/33
North Raccoon River						
Manson	M-103	0.110	P.S.	C.D.	C.D.	
Knierim	M-104	NEMTF	----	----	----	
Somers	M-105	NEMTF	----	----	----	
Rinard	M-106	0.003	1/1	0.008	2/1	--[4/]/10
Lohrville	M-107	0.053	13/4	0.056	14/7	[4/]
Scranton	M-108	0.065	19/10	0.065	16/8	3/2
Jefferson	M-109	0.485	162/55	0.606	152/30	10/25
Farnhamville	M-110	0.110	P.S.	C.D.	C.D.	
Churdan	M-111	0.028	P.S.	C.D.	C.D.	
Callender	M-112	0.02	P.S.	C.D.	C.D.	
Gowrie	M-113	NA	41/8	0.081	20/10	21/--[4/]
Harcourt	M-114	NEMTF	----	C.D.	C.D.	
Paton	M-115	NEMTF	----	C.D.	C.D.	
Dana	M-116	NEMTF	----	----		
Jamaica	M-118	NEMTF	----	C.D.	C.D.	
Rippey	M-119	0.012	P.S.	C.D.	C.D.	
Dawson	M-120	NEMTF	----	C.D.	C.D.	
Perry	M-121	1.052	307/70	1.378	345/23	--[4/]/47
Oscar Mayer	I-56	0.90	563/525	1.233	339/41	224/484
Minburn	M-122	NA	P.S.	C.D.	C.D.	
Adel	M-124	0.400	100/37	0.224	56/28	44/9
Segment Total			1206/710		944/148	302/567

TABLE VI-3 CONTINUED

Dischargers	Reference Number	Present Flow (mgd)	Present lbs.Eff. BOD_5/NH_3	Projected (1990) Flow (mgd)	Projected (1990) lbs.Eff. BOD_5/NH_3	Load Reduction BOD/NH_3
South Raccoon River						
Guthrie Center	M-125	0.186	54/20	0.196	49/25	5/--4/
Arcadia	M-126	NEMTF	----	C.D.	C.D.	
Halbur	M-127	NEMTF	----	0.024	6/3	4/
Dedham	M-128	0.009	P.S.	C.D.	C.D.	
Stuart	M-129	0.201	42/22	0.203	50/25	4/
Segment Total			96/42		105/53	4/
Middle Raccoon River						
Breda	M-130	0.065	P.S.	C.D.	C.D.	0/39
Carroll	M-131	0.805	181/67	1.075	260/28	--4//39
Lidderdale	M-132	0.015	P.D.	C.D.	C.D.	
Willey	M-133	NEMTF	----	----	----	
Coon Rapids	M-134	0.081	17/6	0.088	22/11	4/
Segment Total			198/73		291/39	--4//39
Middle Raccoon River						
Glidden	M-135	0.003	26/5	0.068	17/8	9/--4/
Ralston	M-136	NEMTF	----	----	----	
Bayard	M-137	NEMTF	----	9.068	17.8	4/
Panora	M-138	0.150	P.S.	C.D.	C.D.	
Linden	M-139	NEMTF	----	0.040	10/5	4/
Bagley	M-140	.036	21*/9*	.039	10/5	4/
Yale	M-141	NEMTF	----	0.032	8/4	4/
Segment Total			26/5		62/30	4/
South Raccoon River						
Redfield	M-142	0.062	P.S.	C.D.	C.D.	
Earlham	M-143	0.236	P.S.	C.D.	C.D.	
De Soto	M-144	0.060	P.S.	C.D.	C.D.	
Segment Total			----		----	
Lower Raccoon River						
Van Meter	M-145	0.033	P.S.	C.D.	C.D.	
Waukee	M-146	NA	P.S.	C.D.	C.D.	
Dallas Center	M-123	0.188	47/3	0.250	65/32	4/
Segment Total			47/3		65/32	4/

TABLE VI-3 CONTINUED

		Present		Projected (1990)		Load Reduction
Dischargers	Reference Number	Flow (mgd)	lbs.Eff. BOD_5/NH_3	Flow (mgd)	lbs.Eff. BOD_5/NH_3	BOD/NH_3
Des Moines River						
Clive	M-147	----	to D.M.	----	1/	
West Des Moines	M-148	----	to D.M.	----	1/	
Windsor Heights	M-149	----	to D.M.	----	1/	
Des Moines #1	M-150	38.9	9733/3569	40.77	3400/680	6333/2889
Des Moines-C	M-222	NA	----	NA	1/	
Four Mile Creek						
Slater	M-152	.090	P.S.	C.D.	C.D.	
Allemen	M-227	0.01	NA	.0236	6/3	
Ankeny E.	M-153	0.910	228/61	2.992	1/	
Altoona	M-155	0.534	134/36	1.513	1/	
Des Moines River						
Pleasant Hill	M-156	0.110	33/8	0.220	1/	
Bondurant	M-175	0.047	P.S.	1.034	1/	
Runnells	M-176	NEMTF	----	0.048	12/6	4/
Pleasantville	M-183	0.047	P.S.	C.D.	C.D.	
Mitchellville	M-184	0.085	25/4	0.176	44/22	4/
Prairie City	M-185	0.037	77/31*	0.140	35/17	42/14
Monroe	M-225	0.040	P.S.	C.D.	C.D.	4/
Knoxville	M-191	0.606	126/50	0.883	221/111	4/
Segment Total			10356/3759		3718/839	6375/2903
North River						
Menlo	M-157	NEMTF	----	0.04	10/5	4/
Dexter	M-158	NA	P.S.	C.D.	C.D.	
Ia. Metro Sewer	M-160	0.100	31/7	C.D.	1/	
Norwalk	M-159	----	To M-160	.323	1/	
Highland Hills	M-151	0.525	175/70	NA	1/	
Des Moines-B	M-223	NA	Under const.	NA	1/	
Greenfield Plaza	M-161	0.350	P.S.	NA	1/	
Carlisle	M-163	0.104	P.S.	C.D.	C.D.	
Segment Total			206/77		2/	4/

TABLE VI-3 CONTINUED

Dischargers	Reference Number	Present Flow (mgd)	Present lbs.Eff. BOD$_5$/NH$_3$	Projected (1990) Flow (mgd)	Projected (1990) lbs.Eff. BOD$_5$/NH$_3$	Load Reduction BOD/NH$_3$
Middle River						
Adair	M-164	0.057	19/3	0.076	19/10	4/
Casey	M-165	0.022	5/1	0.059	15/7	4/
Winterset	M-166	0.032	75/16	0.446	37/11	38/5
Patterson	M-167	NEMTF	----	C.D.	C.D.	
Bevington	M-168	NEMTF	----	----	----	
Martensdale	M-169	NA	P.S.	C.D.	C.D.	
East Peru	M-170	NEMTF	----	----	----	
Truro	M-171	0.045	P.S.	C.D.	C.D.	
St. Charles	M-172	NEMTF	----	C.D.	C.D.	
Spring Hill	M-173	NEMTF	----	C.D.	C.D.	
Indianola N.	M-174	0.651	136/16	1.034	86/26	50/--4/
Segment Total			235/36		157/54	88/--4/
South River						
St. Marys	M-177	NEMTF	----	----	----	
New Virginia S.D.	M-178	0.028	P.S.	C.D.	C.D.	
Indianola S.	M-179	0.45	94/11	0.40	100/50	4/
Milo	M-180	NA	P.S.	C.D.	C.D.	
Ackworth	M-181	NEMTF	----	----	----	
Sandyville	M-182	NEMTF	----	----	----	
Segment Total			94/11		100/50	4/
White Breast Creek						
Osceola	M-186-1	0.573	243/48	Abandon		---
	M-186-2	0.19	73/36	1.0	250/125	66/--4/
Woodburn	M-187	NEMTF	---	---	---	---
Lucas	M-188	NEMTF	---	0.026	7/8	-4//--4/
Williamson	M-189	NEMTF	---	0.023	6/3	-4//--4/
Lacona	M-190	0.034	7/0.6	C.D.	C.D.	---
Segment Total			323/85		263.136	66/--4/
Des Moines River						
Pella S.W.	M-192	0.054	14/1	0.016	9/5	5/--4/
Melcher	M-193	0.10	P.S.	C.D.	C.D.	
Dallas	M-194	---	To M-193	---	To M-193	
Harvey	M-195	NEMTF	---	0.024	6/3	4/

TABLE VI-3 CONTINUED

Dischargers	Reference Number	Present Flow (mgd)	Present lbs.Eff. BOD_5/NH_3	Projected (1990) Flow (mgd)	Projected (1990) lbs.Eff. BOD_5/NH_3	Load Reduction BOD_5/NH_3
Des Moines River Cont.						
Melrose	M-196	NEMTF	----	----	----	
Marysville	M-197	NEMTF	----	----	----	
Lovilia	M-198	0.028	P.S.	C.D.	C.D.	
Hamilton	M-199	NEMTF	----	C.D.	C.D.	
Bussey	M-200	NA	P.S.	C.D.	C.D.	
Leighton	M-201	NEMTF	----	----	----	
Beacon	M-202	0.023	P.S.	C.D.	C.D.	
Oskaloosa S.	M-203	0.052	11/3	0.092	23/11	4/
Oskaloosa S.W.	M-204	0.410	171/55	0.807	202/101	4/
Albia S.W.	M-205	0.114	88/13	To Be Abandoned		88/13
Albia N.	M-206	0.273	121/46	0.50	124/62	4/
Eddyville	M-207	0.138	P.S.	C.D.	C.D.	
Kirkville	M-208	NEMTF	----	0.028	7/4	4/
Chillicothe	M-209	NEMTF	----	----	----	4/
Segment Total			405/118		371/186	4/
Des Moines River						
Ottumwa	M-210	2.18	418/127	10.7	1786/893	4/
Eldon	M-211	NA	P.S.	C.D.	C.D.	
Moravia	M-212	0.053	P.S.	C.D.	C.D.	
Blakesburg	M-213	NEMTF	----	0.052	13/7	4/
Floris	M-214	NEMTF	----	----	----	4/
Libertyville	M-215	NEMTF	----	0.040	10/5	4/
Keosauqua	M-216	0.079	P.S.	C.D.	C.D.	
Bonaparte	M-217	NEMTF	----	0.052	13/7	4/
Farmington	M-218	NEMTF	----	0.084	21/11	4/
Segment Total			418/127		1786/893	4/
Sugar Creek						
Donnellson	M-219	0.078	17/8	0.111	9/2	8/6
Segment Total			17/8		9/2	8/6

P.S. - Partial Storage
C.D. - Controlled Discharge
* Engineering Estimate
1/ In accordance with 208 plan for Des Moines Metro Area.
2/ Not a true representative value because of lack of 201 or 208 plans.
3/ DEQ 1974 Need Survey.
4/ Minor load increased due to increased population growth or new STP being constructed with increased flows.

to be subsequently used in establishing priorities and output estimates for municipal facilities construction. The relative significance of each discharger is determined by its total points as calculated by the discharger ranking formula. The specific details and rationale used for the municipal discharger ranking methodology have been described in Chapter I.

Table VI-4 lists the municipalities in the basin, their priority points, and their final ranking.

TABLE VI-4

MUNICIPAL DISCHARGER RANKING

Rank	Municipality	Discharge Criteria						Segment Points	Priority Points
		$\underline{A}_1$	$\underline{A}_2$	$\underline{B}_1$	$\underline{B}_2$	$\underline{D}_1$	$\underline{D}_2$		
1	Estherville	60	50	.91	.92	21	18	24	160.44
2	Ankeny Ind.	60	40	.69	.50	14	12	28	105.39
3	Eagle Grove	50	30	.51	.92	16	12	25	98.72
4	Des Moines #1	20	20	.65	.81	25	25	29	94.77
5	Albia S.W.	60	20	.78	.31	12	9	26	91.38
6	Clarion	50	30	.47	.86	14	12	25	90.80
7	Bagley	60	40	.52	.44	9	7	15	72.03
8	Bancroft	60	30	.62	.33	12	9	12	69.73
9	Storm Lake	30	40	.00	.87	16	18	18	68.59
10	Whittemore	60	1	.77	.38	14	5	9	67.34
11	Ankeny S.W.	30	30	.00	.97	14	14	22	64.82
12	Emmetsburg	30	20	.39	.68	12	12	24	62.71
13	Prairie City	20	20	.55	.45	12	12	29	60.91
14	Eddyville	50	10	.53	.00	12	7	26	58.94
15	Webster City	20	20	.00	.83	16	16	25	54.82
16	Boone	40	20	.14	.50	16	16	28	53.54
17	Sac City	30	20	.22	.80	12	9	18	50.53
18	Panora	30	30	.41	.48	9	9	15	49.67
19	Fort Dodge	30	20	.00	.66	18	18	20	45.00
20	Goldfield	40	10	.40	.00	5	1	25	43.00

TABLE VI-4 (continued)

MUNICIPAL DISCHARGER RANKING

Rank	Municipality	Discharge Criteria						Segment Points	Priority Points
		A_1	A_2	B_1	B_2	D_1	D_2		
21	Laurens	30	20	.25	.82	12	9	8	42.18
22	Fonda	50	10	.43	.60	9	5	8	42.08
23	Rockwell City	20	30	.00	.54	12	12	19	41.80
24	Albia N.	50	30	.24	.00	14	12	26	41.36
25	Polk City	30	20	.30	.00	9	7	28	39.82
26	Donnellson	20	20	.47	.75	7	7	6	38.96
27	Bondurant	40	20	.21	.00	7	5	29	38.89
28	Adel	20	20	.44	.24	12	12	16	37.86
29	Winterset	20	10	.51	.31	12	9	15	37.15
30	Britt	30	1	.28	.00	12	5	25	36.55
31	Slater	50	20	.11	.00	9	9	29	35.55
32	Lake View	20	20	.00	.56	9	9	19	35.11
33	Ogden	30	20	.31	.53	12	12	5	34.96
34	Kanawha	30	1	.25	.00	9	0	25	34.75
35	Jefferson	30	20	.06	.45	14	14	16	34.17
36	Pella S.W.	30	10	.21	.00	7	1	26	33.93
37	Dayton	30	10	.12	.00	9	7	28	32.68
38	Farnhamville	20	10	.57	.00	9	5	16	32.39
39	Perry	30	10	.00	.67	16	14	16	32.11
40	Glidden	40	20	.35	.00	9	5	15	31.96
41	Graettinger	30	1	.19	.00	12	5	24	31.78

TABLE VI-4 (continued)

MUNICIPAL DISCHARGER RANKING

Rank	Municipality	Discharge Criteria						Segment Points	Priority Points
		A_1	A_2	B_1	B_2	D_1	D_2		
42	Des Moines Highland Hills	30	30	.38	.23	14	14	4	30.90
43	Gowrie	20	10	.51	.00	9	7	16	30.85
44	Rolfe	30	20	.18	.00	7	5	24	30.73
45	Corwith	30	11	.14	.00	7	0	25	30.29
46	Melcher	30	10	.11	.00	9	5	26	30.18
47	Pocahontas	30	10	.22	.00	12	9	21	30.04
48	West Bend	30	10	.14	.00	9	5	24	29.32
49	Lake City S.W.	30	20	.09	.25	9	7	19	29.24
50	Scranton	30	30	.16	.20	7	7	16	29.24
51	Breda	30	10	.36	.00	9	5	15	29.18
52	Des Moines "C"	00	00	.00	.00	00	00	29	29.00
53	Ankeny E.	20	10	.00	.00	14	14	29	29.00
54	Knoxville	20	20	.00	.00	14	12	29	29.00
55	Altoona	20	10	.00	.00	14	12	29	29.00
56	Pleasant Hill	30	20	.00	.00	9	7	29	29.00
57	Mitchellville	30	10	.00	.00	9	5	29	29.00
58	Monroe	30	30	.00	.00	7	7	29	29.00
59	Runnells	00	00	.00	.00	00	00	29	29.00
60	Allemen	00	00	.00	.00	00	00	29	29.00
61	Madrid	30	20	.00	.00	12	9	28	28.00
62	Stratford	20	20	.00	.00	7	5	28	28.00

TABLE VI-4 (continued)

MUNICIPAL DISCHARGER RANKING

Rank	Municipality	Discharge Criteria						Segment Points	Pirority Points
		$\underline{A}_1$	$\underline{A}_2$	$\underline{B}_1$	$\underline{B}_2$	$\underline{D}_1$	$\underline{D}_2$		
63	Sheldahl	00	00	.00	.00	00	00	28	28.00
64	Boxholm	00	00	.00	.00	00	00	28	28.00
65	Pilot Mound	00	00	.00	.00	00	00	28	28.00
66	Luther	00	00	.00	.00	00	00	28	28.00
67	Earlham	20	10	.56	.00	12	7	10	27.90
68	Burt	40	10	.30	.00	12	7	12	27.79
69	Titonka	30	30	.13	.30	7	7	12	27.73
70	Indianola N.	20	10	.37	.00	14	9	15	27.50
71	Lytton	30	10	.19	.00	12	7	19	27.08
72	Carroll	20	20	.00	.33	14	14	15	26.16
73	Oskaloosa S.W.	40	30	.00	.00	14	14	26	26.00
74	Oskaloosa S.	20	10	.00	.00	7	5	26	26.00
75	Beacon	30	20	.00	.00	5	3	26	26.00
76	Lovilia	30	10	.00	.00	1	00	26	26.00
77	Bussey	20	20	.00	.00	3	3	26	26.00
78	Dallas	00	00	.00	.00	00	00	26	26.00
79	Kirkville	00	00	.00	.00	00	00	26	26.00
80	Harvey	00	00	.00	.00	00	00	26	26.00
81	Hamilton	00	00	.00	.00	00	00	26	26.00
82	Chillicothe	00	00	.00	.00	00	00	26	26.00
83	Lake City N.	20	20	.00	.25	9	7	19	25.75
84	Renwick	20	10	.00	.00	7	3	25	25.00

TABLE VI-4 (continued)

MUNICIPAL DISCHARGER RANKING

Rank	Municipality	Discharge Criteria A_1	A_2	B_1	B_2	D_1	D_2	Segment Points	Priority Points
85	Wesley	00	00	.00	.00	00	00	25	25.00
86	Luverne	00	00	.00	.00	00	00	25	25.00
87	Woolstock	00	00	.00	.00	00	00	00	25.00
88	Thor	00	00	.00	.00	00	00	25	25.00
89	Gilmore City	20	10	.14	.00	9	5	21	24.95
90	Humboldt	10	10	.00	.00	14	12	24	24.00
91	Mallard	00	00	.00	.00	00	00	24	24.00
92	Bode	40	10	.33	.00	5	1	9	24.00
93	Wallingford	00	00	.00	.00	00	00	24	24.00
94	Ayshire	00	00	.00	.00	00	00	24	24.00
95	Rutland	00	00	.00	.00	00	00	24	24.00
96	Gruver	00	00	.00	.00	00	00	24	24.00
97	Cylinder	00	00	.00	.00	00	00	24	24.00
98	Waukee	20	20	.00	.00	9	9	23	23.00
99	Dallas Center	20	1	.00	.00	9	5	23	23.00
100	Van Meter	40	20	.00	.00	7	5	23	23.00
101	Osceola E.	30	30	.16	.35	9	12	2	22.69
102	Badger	30	20	.00	.00	5	5	21	21.00
103	Clare	00	00	.00	.00	00	00	21	21.00
104	Moorland	00	00	.00	.00	00	00	21	21.00
105	Havelock	00	00	.00	.00	00	00	21	21.00
106	Palmer	00	00	.00	.00	00	00	21	21.00

TABLE VI-4 (continued)

MUNICIPAL DISCHARGER RANKING

Rank	Municipality	Discharge Criteria						Segment Points	Priority Points
		A_1	A_2	B_1	B_2	D_1	D_2		
107	Barnam	00	00	.00	.00	00	00	21	21.00
108	Pomeroy	30	10	.05	.00	9	3	19	20.86
109	Otho	30	10	.00	.00	7	1	20	20.00
110	Lehigh	30	1	.00	.00	7	1	20	20.00
111	Savage S.D.	20	20	.00	.00	5	5	20	20.00
112	Duncombe	20	1	.00	.00	5	00	20	2.00
113	Vincent	00	00	.00	.00	00	00	20	20.00
114	De Soto	30	30	.07	.20	7	7	10	19.71
115	Manson	30	20	.00	.00	9	7	19	19.00
116	Auburn	00	00	.00	.00	00	00	19	19.00
117	Lanesboro	00	00	.00	.00	00	00	19	19.00
118	Somers	00	00	.00	.00	00	00	19	19.00
119	Rinard	20	20	.00	.00	00	00	19	19.00
120	Albert City	20	10	.00	.00	7	5	18	18.00
121	Rembrandt	20	30	.00	.00	3	3	18	18.00
122	Marathon	00	00	.00	.00	00	00	18	18.00
123	Lakeside	00	00	.00	.00	00	00	18	18.00
124	Ottumwa	20	10	.00	.00	16	16	17	17.00
125	Eldon	20	10	.00	.00	9	9	17	17.00
126	Keosauqua	30	1	.00	.00	9	1	17	17.00
127	Moravia	20	20	.00	.00	7	5	17	17.00
128	Farmington	00	00	.00	.00	00	00	17	17.00

TABLE VI-4 (continued)

MUNICIPAL DISCHARGER RANKING

Rank	Municipality	Discharge Criteria A_1	A_2	B_1	B_2	D_1	D_2	Segment Points	Priority Points
129	Bonaparte	00	00	.00	.00	00	00	17	17.00
130	Blakesburg	00	00	.00	.00	00	00	17	17.00
131	Libertyville	00	00	.00	.00	00	00	17	17.00
132	Dakota City	30	20	.15	.00	7	5	11	16.69
133	Lohrville	20	20	.00	.00	7	5	16	16.00
134	Minburn	20	10	.00	.00	5	1	16	16.00
135	Churdan	20	10	.00	.00	5	1	16	16.00
136	Callender	20	20	.00	.00	1	1	16	16.00
137	Rippey	20	10	.00	.00	1	00	16	16.00
138	Paton	00	00	.00	.00	00	00	16	16.00
139	Harcourt	00	00	.00	.00	00	00	16	16.00
140	Jamaica	00	00	.00	.00	00	00	16	16.00
141	Dawson	00	00	.00	.00	00	00	16	16.00
142	Coon Rapids	20	20	.00	.00	7	7	15	15.00
143	Adair	40	10	.00	.00	7	5	15	15.00
144	Truro	20	20	.00	.00	5	5	15	15.00
145	Martensdale	20	10	.00	.00	5	3	15	15.00
146	Casey	20	10	.00	.00	3	00	15	15.00
147	Lidderdale	20	20	.00	.00	3	3	15	15.00
148	Bayard	00	00	.00	.00	00	00	15	15.00
149	Hartford	00	00	.00	.00	00	00	15	15.00

TABLE VI-4 (continued)

MUNICIPAL DISCHARGER RANKING

Rank	Municipality	Discharge Criteria						Segment Points	Priority Points
		A_1	A_2	B_1	B_2	D_1	D_2		
150	St. Charles	00	00	.00	.00	00	00	15	15.00
151	Yale	00	00	.00	.00	00	00	15	15.00
152	Linden	00	00	.00	.00	00	00	15	15.00
153	Spring Hill	00	00	.00	.00	00	00	15	15.00
154	Patterson	00	00	.00	.00	00	00	15	15.00
155	Dexter	40	20	.21	.00	9	7	4	14.50
156	Osceola S.	50	20	.19	.00	14	12	2	14.42
157	Urbandale S.D.	20	20	.00	.00	12	9	14	14.00
158	Grimes	20	10	.00	.00	9	5	14	14.00
159	Granger	30	30	.00	.00	7	7	14	14.00
160	Johnston	00	00	.00	.00	00	00	14	14.00
161	Algona	30	10	.00	.00	14	12	12	12.00
162	Armstrong	20	1	.00	.00	9	7	12	12.00
163	Swea City	40	20	.00	.00	7	5	12	12.00
164	Ringsted	20	10	.00	.00	5	1	12	12.00
165	Livermore	20	1	.00	.00	5	00	12	12.00
166	Fenton	00	00	.00	.00	00	00	12	12.00
167	Newell	30	10	.08	.00	9	5	8	11.12
168	Guthrie Center	30	20	.09	.00	12	9	7	10.89
169	Redfield	30	10	.00	.00	9	5	10	10.00
170	Stuart	20	20	.00	.00	9	9	7	7.00
171	Dedham	20	20	.00	.00	1	3	7	7.00

TABLE VI-4 (continued)

MUNICIPAL DISCHARGER RANKING

Rank	Municipality	Discharge Criteria						Segment Points	Priority Points
		A_1	A_2	B_1	B_2	D_1	D_2		
172	Arcadia	00	00	.00	.00	00	00	7	7.00
173	Halbur	00	00	.00	.00	00	00	7	7.00
174	Woodward	20	10	.00	.00	9	5	5	5.00
175	Grand Junction	30	1	.00	.00	7	0	5	5.00
176	Bouton	00	00	.00	.00	00	00	5	5.00
177	Des Moines Area B	00	00	.00	.00	00	00	4	4.00
178	Greenfield Plaza	00	00	.00	.00	00	00	4	4.00
179	Carlisle	20	1	.00	.00	9	1	4	4.00
180	Norwalk	00	00	.00	.00	00	00	4	4.00
181	Menlo	00	00	.00	.00	00	00	4	4.00
182	Cumming	00	00	.00	.00	00	00	4	4.00
183	Indianola S.	20	10	.00	.00	12	9	3	3.00
184	Pleasantville	30	10	.00	.00	7	5	3	3.00
185	Milo	50	40	.00	.00	1	3	3	3.00
186	New Virginia S.D.	20	20	.00	.00	5	3	3	3.00
187	Ackworth	00	00	.00	.00	00	00	3	3.00
188	Lacona	20	1	.00	.00	5	00	2	2.00
189	Lucas	00	00	.00	.00	00	00	2	2.00
190	Williamson	00	00	.00	.00	00	00	2	2.00
191	Woodburn	00	00	.00	.00	00	00	2	2.00
192	Buffalo Center	00	00	.00	.00	00	00	1	1.00
193	Ledyard	00	00	.00	.00	00	00	1	1.00

TABLE VI-4 (continued)

MUNICIPAL DISCHARGER RANKING

Rank	Municipality	Discharge Criteria $\underline{A}_1$	$\underline{A}_2$	$\underline{B}_1$	$\underline{B}_2$	$\underline{D}_1$	$\underline{D}_2$	Segment Points	Priority Points
194	Lakota	00	00	.00	.00	00	00	1	1.00
195	Rake	00	00	.00	.00	00	00	1	1.00

REFERENCES

1. Supporting Document For Iowa Water Quality Management Plans, Iowa Department of Environmental Quality, Water Quality Management Division, Des Moines, Iowa 1976.

CHAPTER VII - NONPOINT POLLUTION SOURCES

Flow contributions into surface waters from sources other than readily identifiable domestic, industrial, commercial and institutional point discharges may have a substantial impact on water quality. The water resource may be adversely affected by nonpoint discharges associated with combined sewer overflows, urban and rural runoff, and agricultural waste.

GENERAL RURAL RUNOFF

Approximately 96 percent of the Des Moines River Basin is classified as agricultural land. The pollution potential of general rural runoff has been developed and related to specific conditions in the study area.

An estimation of the land use in each drainage area was developed using the 1970 Iowa Conservation Needs Inventory, (4). Land use acreages are listed in Table VII-1.

A detailed analysis was conducted to estimate nutrient losses within the study area. Nutrient loads in the basin were estimated based on sampling conducted below the Saylorville Dam (prior to closing). Actual nutrient loadings were measured. A significant relationship was found to exist between the flow and the nutrient concentration. The total annual nutrient load was then estimated based on the sampling analysis and

TABLE VII - 1

LAND USE CLASSIFICATIONS

Hydrologic Unit	Land Use in Acres							
	Cropland	Pasture	Forest	Federal	Urban	Small Water	Other	Total
W. Fork Des Moines	516,275	25,091	9,037	6	20,635	194	22,828	594,066
E. Fork Des Moines	646,558	32,798	9,160	1,342	26,119	459	24,225	740,691
Blue Earth	176,321	7,461	2,526	492	6,818	35	6,902	200,555
Boone	461,211	19,023	10,072	237	22,855	449	14,191	528,038
Upper Des Moines	861,556	66,938	59,887	278	75,093	659	28,944	1,093,355
Raccoon	1,367,289	90,058	44,947	444	67,877	1,522	41,156	1,613,293
Middle & South Raccoon	513,173	88,847	48,369	291	22,666	1,299	23,054	697,699
North River	156,838	47,588	30,226	300	13,162	681	9,410	258,205
Middle River	214,000	63,895	37,098	475	16,245	928	13,803	346,444
South River	148,471	54,094	34,163	883	10,486	927	18,287	267,311
Lower Des Moines	1,047,379	397,796	322,673	38,426	98,792	3,688	76,911	1,975,665
	6,109,071	893,589	608,158	33,174	380,748	10,841	279,741	8,315,322

the flow duration curve for the Des Moines River at Saylorville. Point source loadings, based on EQAP data, were subtracted from the total loadings, yielding the nonpoint nutrient contribution.

The results of this analysis are shown in Table VII-2. Annual nitrogen and phosphorus losses were 10.87 and 1.35 lbs/acre respectively. Nonpoint runoff accounted for 98.3 percent of the nitrogen and 89.6 percent of the phosphorus in the river. The estimated nutrient loading for each hydrologic unit was then estimated based on the average annual loss per acre calculated for the Des Moines River above Saylorville (Table VII-3).

The 1970 Conservation Needs Inventory (4) was used to summarize treatment measures necessary to reduce surface runoff and limit soil losses to levels established by the Soil Conservation Districts (Table VII-4). The associated implementation costs were then developed based on these needs and cost estimates provided by the Soil Conservation Service (Table VII-5). The cost of treatment measures to reduce runoff from cropland was by far the largest cost segment since cropland would be more susceptible to runoff due to limited soil cover. Annual costs developed by Stanley Consultants for the various types of treatment are also listed in Table VII-5. Total capital costs are shown in Table VII-6. The total capital cost of the runoff control measures for the Des Moines River Basin is almost 340 million dollars.

TABLE VII-2

ESTIMATED* ANNUAL NUTRIENT LOAD IN THE DES MOINES RIVER AT SAYLORVILLE

Nutrient	Estimated Lbs/Yr Stream	Estimated Lbs/Yr Point Sources	Estimated Lbs/Yr Nonpoint Sources	Acres Drainage Area	Annual Runoff Lbs/Acre	Nonpoint Percent of Total
Phosphorus	5,621,007	586.015	5,034,992	3,738,240	1.35	89.6
Nitrogen	41,334,897	695,235	40,639,662	3,738,340	10.87	98.3

* BASED ON WATER QUALITY AND FLOW DATA

TABLE VII-3

ESTIMATED NUTRIENT LOADINGS FROM NONPOINT SOURCES

Hydrologic Unit	Nitrogen Lbs/Yr	Phosphorus Lbs/Yr
West Fork Des Moines	6,457,498	861,990
East Fork Des Moines	8,051,312	999,933
Blue Earth	2,180,033	270,750
Boone	5,739,773	712,852
Upper Des Moines	11,884,769	1,476,030
Raccoon	17,536,495	2,177,946
Middle & South Raccoon	7,583,989	941,894
North River	2,806,689	348,577
Middle River	3,765,847	467,700
South River	2,905,671	360,870
Lower Des Moines	21,475,479	2,667,148
Total	90,387,555	11,225,690

TABLE VII-4

RUNOFF CONTROL MEASURES REQUIRED

DES MOINES RIVER BASIN

Hydrologic Unit	Cropland Acres		Pasture Acres				Acres
	Terracing Stripcropping	Grade Stabilization	Diversions	Land Conversions	Critical Area Planting	Grassland Management	Woodland Management
West Fork Des Moines	87,486	8,433	1,386	0	11,557	584	16,354
East Fork Des Moines	75,048	60,585	2,693	0	8,056	981	7,857
Blue Earth	20,406	20,484	980	0	1,307	313	1,830
Boone	44,113	76,363	5,895	535	1,703	144	7,631
Upper Des Moines	64,708	82,572	11,757	505	4,040	5,269	37,546
Raccoon	209,854	93,917	15,593	1,253	6,848	2,858	29,690
Middle & South Raccoon	184,407	35,437	7,134	385	11,514	814	33,857
North River	65,282	2,095	5,139	0	5,751	3,443	16,442
Middle River	92,391	2,251	6,062	16	10,368	4,053	20,306
South River	54,400	3,826	5,450	458	4,518	2,176	19,565
Lower Des Moines	369,380	96,112	31,062	1,580	145,494	31,509	180,712
Total	1,267,475	482,075	93,151	4,732	211,156	52,144	371,790

TABLE VII-5

UNIT COSTS FOR STATEWIDE CONTROLS

Land Use	Total Cost	Total Acres	Capital Cost/Acre	Annual Cost/Acre
Cropland				
Stripcropping and Terracing	$824,677,000	7,932,499	$ 103.96	$5.00
Grade Stabilization	$638,440,000	1,873,037	$ 340.86	$1.50
Pasture				
Diversions	$ 7,003,000	610,660	$ 11.47	$5.00
Land Conversions	$ 29,647,000	16,682	$1,777.18	$2.00
Critical Area Planting	$ 8,002,000	715,003	$ 11.19	$1.00
Grassland Management	$ 9,296,000	229,332	$ 40.54	$1.00
Woodland				
Woodland Management	$160,080,000	2,055,435	$ 77.88	$2.00
	$1,677,145,000	13,432,648		

TABLE VII-6

RUNOFF CONTROL COSTS BY SUBBASIN

DES MOINES RIVER BASIN

Hydrologic Unit	Cropland		Pasture					
	Terracing Stripcropping	Grade Stabilization	Diversions	Land Conversions	Critical Area Planting	Grassland Management	Woodland Management	Total
West Fork Des Moines	$ 9,095,203	$ 2,874,457	$ 15,895	$ 0	$ 129,341	$ 23,673	$ 1,273,671	$ 13,412,240
East Fork Des Moines	$ 7,802,126	$ 20,650,893	$ 30,883	$ 0	$ 90,159	$ 39,765	$ 611,914	$ 29,225,740
Blue Earth	$ 2,121,445	$ 6,982,139	$ 11,239	$ 0	$ 14,627	$ 12,687	$ 142,523	$ 9,284,660
Boone	$ 4,586,067	$ 26,028,953	$ 67,603	$ 950,794	$ 19,059	$ 5,837	$ 594,312	$ 32,252,625
Upper Des Moines	$ 6,727,161	$ 28,145,342	$ 134,828	$ 897,478	$ 45,214	$ 213,580	$ 2,924,132	$ 39,087,735
Raccoon	$ 21,816,802	$ 32,012,378	$ 178,819	$2,226,813	$ 76,640	$ 115,849	$ 2,312,297	$ 58,739,598
Middle and South Raccoon	19,171,285	$ 12,078,991	$ 81,812	$ 684,216	$ 128,860	$ 32,996	$ 2,636,828	$ 34,814,988
North River	$ 6,786,835	$ 714,098	$ 58,934	$ 0	$ 64,363	$ 139,562	$ 1,280,525	$ 9,044,317
Middle River	$ 9,605,136	$ 767,272	$ 69,519	$ 28,435	$ 116,034	$ 164,289	$ 1,581,458	$ 12,332,143
South River	$ 5,655,522	$ 1,304,123	$ 62,500	$ 813,951	$ 50,563	$ 88,204	$ 1,523,748	$ 9,498,611
Lower Des Moines	$ 38,401,413	$ 32,760,561	$ 356,216	$2,807,952	$1,628,305	$1,277,221	$14,074,090	$ 91,305,758
Total	$131,768,995	$164,319,207	$1,068,248	$8,409,639	$2,363,165	$2,113,663	$28,955,498	$338,998,416

ANIMAL FEEDING OPERATIONS

In order to determine the size and location of livestock facilities in the study area, information was gathered on feeding operations registered with the Department of Environmental Quality. Livestock census information was obtained from the Iowa Annual Farm Census, 1971 (3) to establish the number and distribution of animals in the study area (Table VII-7). The inventory information developed is representative of conditions at a particular point in time. A completely accurate account of livestock feeding operation capacity is not practical or even possible. The number of livestock on feed and even the number of feeding operations is subject to many variables, the most significant of which is livestock marketing conditions. The inventory data accumulated for the basin, however, does highlight livestock feeding as a significant potential source of water pollution. The locations of registered animal feeding operations are shown on Figures VII-1, VII-2, and VII-3. The animal numbers of each operation may be identified through the appropriate reference number in Tables VII-8, VII-9, and VII-10.

Cattle densities in the basin range from a low of 0.04 head per acre in the Lower Des Moines Subbasin to a high of 0.15 in the West Fork Des Moines River drainage area. Swine densities vary between 0.28 head per acre in the main stem Upper Des Moines River drainage area to 0.49 in the East Fork Des Moines River drainage area.

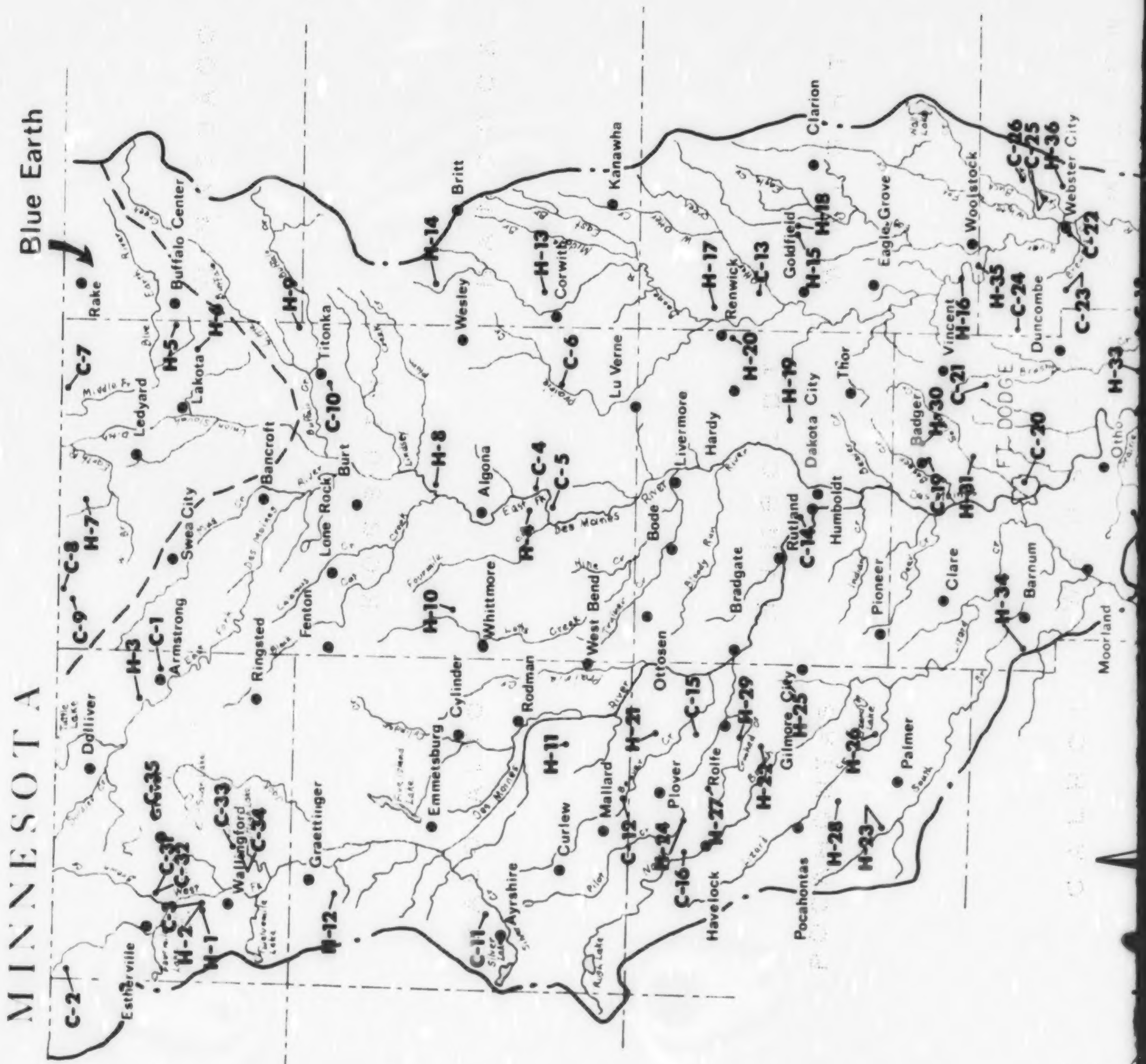
Because of insufficient data, quantitative estimates of potential pollution loads from feeding operations were not calculated. As

TABLE VII-7

LIVESTOCK DISTRIBUTION BY SUBBASIN

DES MOINES RIVER BASIN

Hydrologic Unit	Hogs	Cattle	Sheep	Poultry
West Des Moines	224,448	66,327	4,440	214,868
East Des Moines	314,318	58,937	7,889	258,812
Blue Earth	92,017	13,847	1,878	75,449
Boone	276,224	36,846	7,957	393,306
Upper Des Moines	336,913	87,232	16,603	752,451
Raccoon	709,911	217,613	25,937	863,502
Middle & South Raccoon	371,230	102,684	4,256	273,853
North River	93,547	9,464	2,006	39,040
Middle River	129,374	12,916	2,885	53,582
South River	79,587	5,675	1,336	24,647
Lower Des Moines	688,758	71,143	45,971	334,082
Total	3,316,327	682,684	121,158	3,283,592


MINNESOTA
Blue Earth
Estherville
Dolliver
Armstrong
Swea City
Ledyard
Lakota
Buffalo Center
Rake
Bancroft
Titonka
Britt
Wesley
Kanawha
Corwith
Lu Verne
Burt
Lone Rock
Fenton
Ringsted
Graettinger
Wallingford
Emmetsburg
Cylinder
Whittmore
Algona
Rodman
West Bend
Ottosen
Bode
Livermore
Hardy
Renwick
Goldfield
Clarion
Eagle Grove
Woolstock
Webster City
Dakota City
Humboldt
Rutland
Bradgate
Thor
Badger
Vincent
Duncombe
FT. DODGE
Otho
Pioneer
Clare
Barnum
Moorland
Gilmore City
Rolfe
Plover
Mallard
Curlew
Ayrshire
Havelock
Pocahontas
Palmer
Silver Lake
Des Moines River
East Fk.
C-1
C-2
C-3
C-4
C-5
C-6
C-7
C-8
C-9
C-10
C-11
C-12
C-13
C-14
C-15
C-16
C-19
C-20
C-21
C-22
C-23
C-24
C-25
C-26
C-31
C-32
C-33
C-34
C-35
H-1
H-2
H-3
H-5
H-6
H-7
H-8
H-9
H-10
H-11
H-12
H-13
H-14
H-15
H-16
H-17
H-18
H-19
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H-21
H-22
H-23
H-24
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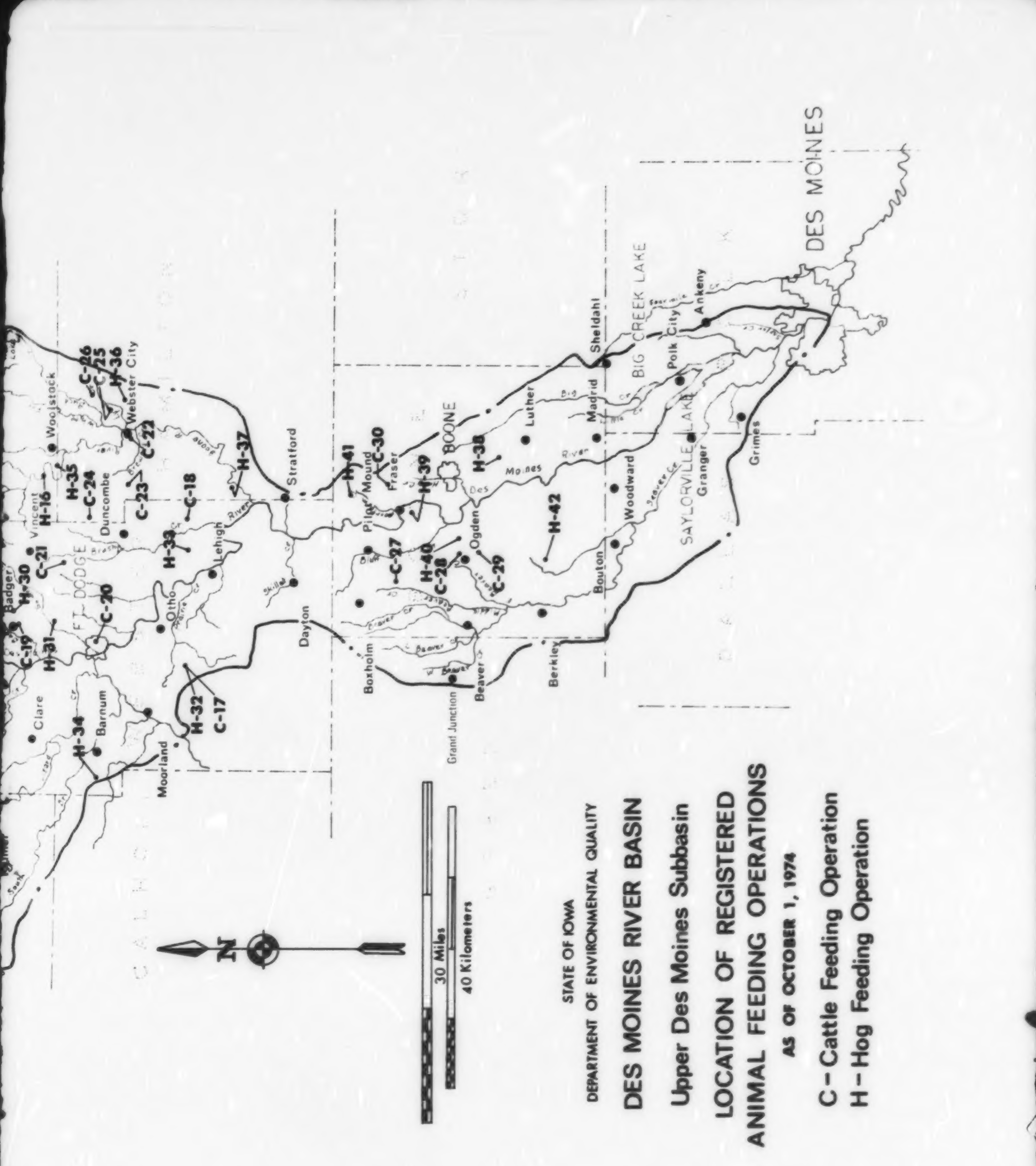
H-33
H-34
H-35
H-36

A


STATE OF IOWA
DEPARTMENT OF ENVIRONMENTAL QUALITY
DES MOINES RIVER BASIN
Upper Des Moines Subbasin
LOCATION OF REGISTERED ANIMAL FEEDING OPERATIONS
AS OF OCTOBER 1, 1974
C – Cattle Feeding Operation
H – Hog Feeding Operation
30 Miles
40 Kilometers
N
FT. DODGE
BOONE
DES MOINES
BIG CREEK LAKE
SAYLORVILLE LAKE
Clare
Barnum
Moorland
Badger
Vincent
Woolstock
Duncombe
Webster City
Otho
Lehigh
Stratford
Dayton
Boxholm
Pilot Mound
Fraser
Ogden
Luther
Madrid
Sheldahl
Woodward
Bouton
Berkley
Beaver
Grand Junction
Polk City
Ankeny
Granger
Grimes
Des Moines River
C-17
C-18
C-19
C-20
C-21
C-22
C-23
C-24
C-25
C-26
C-27
C-28
C-29
C-30
H-16
H-30
H-31
H-32
H-33
H-34
H-35
H-36
H-37
H-38
H-39
H-40
H-41
H-42

B

FIGURE VII-1

TABLE VII-8

ANIMAL FEEDING OPERATIONS; UPPER DES MOINES RIVER SUBBASIN

Registration No.	County	No. Of Animals	Ref. No.	Type Controls*
		HOG FEEDING OPERATIONS		
2-08-00-4-01	Boone	750	H-38	SL
" 04		1,385	H-39	SL
" 05		3,180	H-40	SL
" 06		400	H-41	ST
" 07		650	H-42	SL
2-32-00-4-01	Emmet	6,400	H- 1	ST
" 02		450	H- 2	ST
" 03		1,200	H- 3	SL
2-40-00-4-03	Hamilton	750	H-35	RC
" 04		480	H-36	ST
" 05		400	H-37	ST
2-41-00-4-02	Hancock	375	H-13	ST
" 04		1,000	H-14	SL
2-46-00-4-01	Humboldt	2,700	H-19	SL
" 02		560	H-20	ST
2-55-00-4-01	Kossuth	2,950	H- 4	SL
" 02		1,800	H- 5	ST
" 03		800	H- 6	SL
" 04		720	H- 7	RC
" 05		2,000	H- 8	SB
" 06		400	H- 9	ST
" 07		2,300	H-10	SL
2-74-00-4-01	Palo Alto	25	H-11	ST
" 02		2,000	H-12	SL
2-76-00-4-01	Pocahontas	300	H-21	ST
" 02		400	H-22	ST
" 03		280	H-23	ST
" 05		280	H-24	ST
" 06		270	H-25	ST
" 07		600	H-26	ST
" 08		600	H-27	ST
" 09		5,280	H-28	SL
" 10		300	H-29	RC

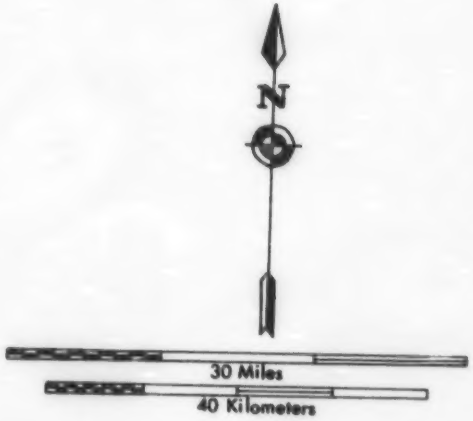
TABLE VII-8

Registration No.		No. Of Animals	Ref. No.	Type Controls*
2-94-00-4-01	Webster	600	H-30	SL
" 03		500	H-31	SL
" 05		150	H-32	ST
" 06		260	H-33	ST
" 09		575	H-34	ST
2-99-00-4-02	Wright	600	H-15	ST
" 03		680	H-16	RC
" 04		3,000	H-17	SL
" 06		642	H-18	ST
	CATTLE FEEDING OPERATIONS			
2-08-00-0-01	Boone	600	C-27	RC
" 02		80	C-28	RC
" 03		NA	C-29	RC
" 05		800	C-30	RC
2-32-00-0-01	Emmet	1,000	C-31	RC
" 02		1,000	C-32	SL
" 03		NA	C-33	RC
" 04		250	C-34	RC
" 05		500	C-35	RC
" 06		500	C- 1	SL
" 08		700	C- 2	ST
' 09		1,200	C- 3	ST
2-40-00-0-02	Hamilton	NA	C-22	NA
" 03		300	C-23	NA
" 06		700	C-24	SL
" 07		345	C-25	SL
" 10		500	C-26	ST
2-46-00-0-01	Humboldt	NA	C-14	NA
2-55-00-0-01	Kossuth	2,000	C- 4	NC
" 02		3,000	C- 5	RC
" 03		3,100	C- 6	RC
" 04		1,000	C- 7	RC
" 05		500	C- 8	SL
" 06		500	C- 9	SL
" 07		1,000	C-10	RC

TABLE VII-8

Registration No.	County	No. Of Animals	Ref. No.	Type Controls*
2-74-00-0-01	Palo Alto	500	C-11	RC
" 02		720	C-12	ST
2-76-00-0-01	Pocahontas	550	C-15	RC
" 02		NA	C-16	ST
2-94-00-0-01	Webster	1,600	C-17	NC
" 02		700	C-18	RC
" 03		NA	C-19	NC
" 04		NA	C-20	NA
" 05		1,500	C-21	SL
2-99-00-0-03	Wright	400	C-13	SL

* SB - Storage Basin
SL - Lagoon
RC - Runoff Controls
ST - Below Building Storage - or Tank
NC - No Control
NA - Not Available


N
30 Miles
40 Kilometers

STATE OF IOWA

DEPARTMENT OF ENVIRONMENTAL QUALITY

DES MOINES RIVER BASIN

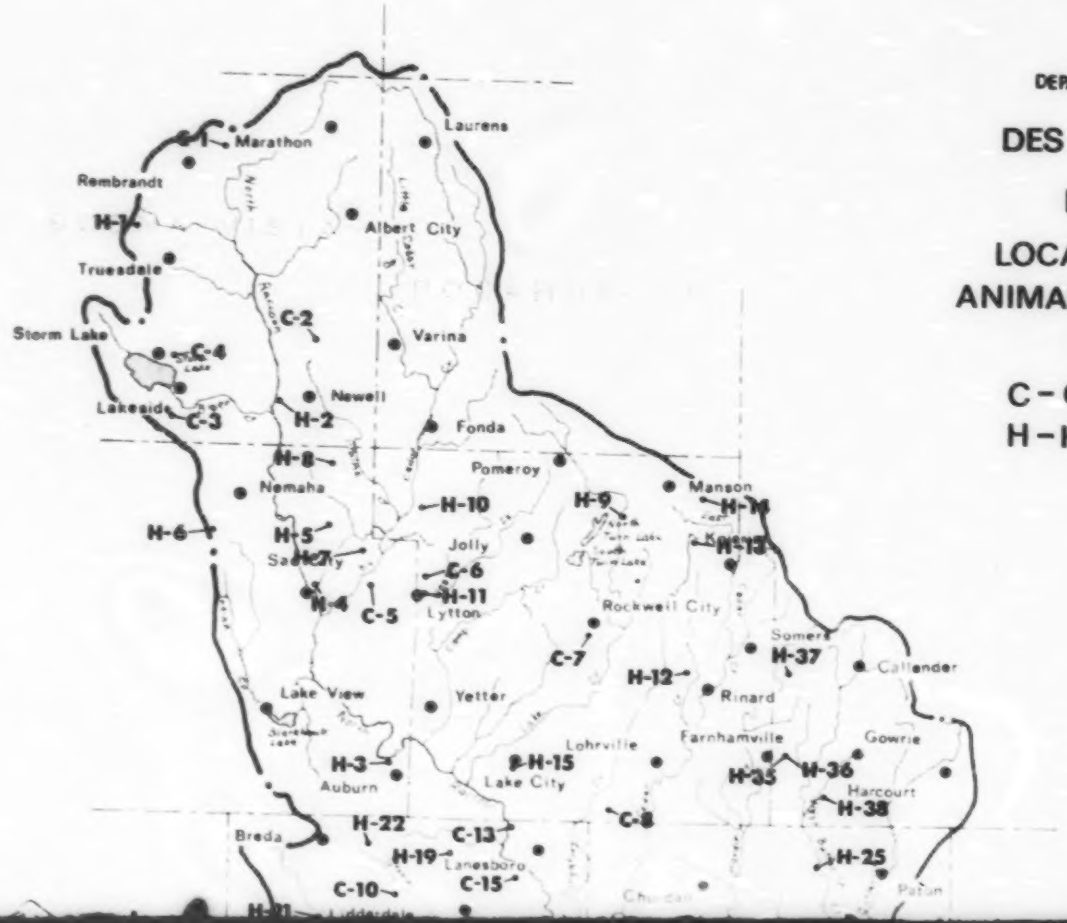
Raccoon Subbasin

LOCATION OF REGISTERED ANIMAL FEEDING OPERATIONS

AS OF OCTOBER 1, 1974

C – Cattle Feeding Operation

H – Hog Feeding Operation


Marathon
Laurens
Rembrandt
H-1
Albert City
Truesdale
North
Little Cedar
Raccoon
C-2
Varina
Storm Lake
C-4
Newell
Lakeside
C-3
H-2
Fonda
H-8
Pomeroy
Nemaha
H-9
Manson
H-14
H-10
H-6
H-5
Jolly
H-7
Sac City
H-13
C-6
H-4
H-11
C-5
Lytton
Rockwell City
Somers
H-37
Callender
C-7
H-12
Rinard
Lake View
Yetter
Lohrville
Farnhamville
Gowrie
H-3
H-15
H-35
H-36
Auburn
Lake City
Harcourt
H-38
C-8
H-22
Breda
C-13
H-19
Lanesboro
H-25
C-10
C-15
Churdan
Paton
H-21
Lidderdale

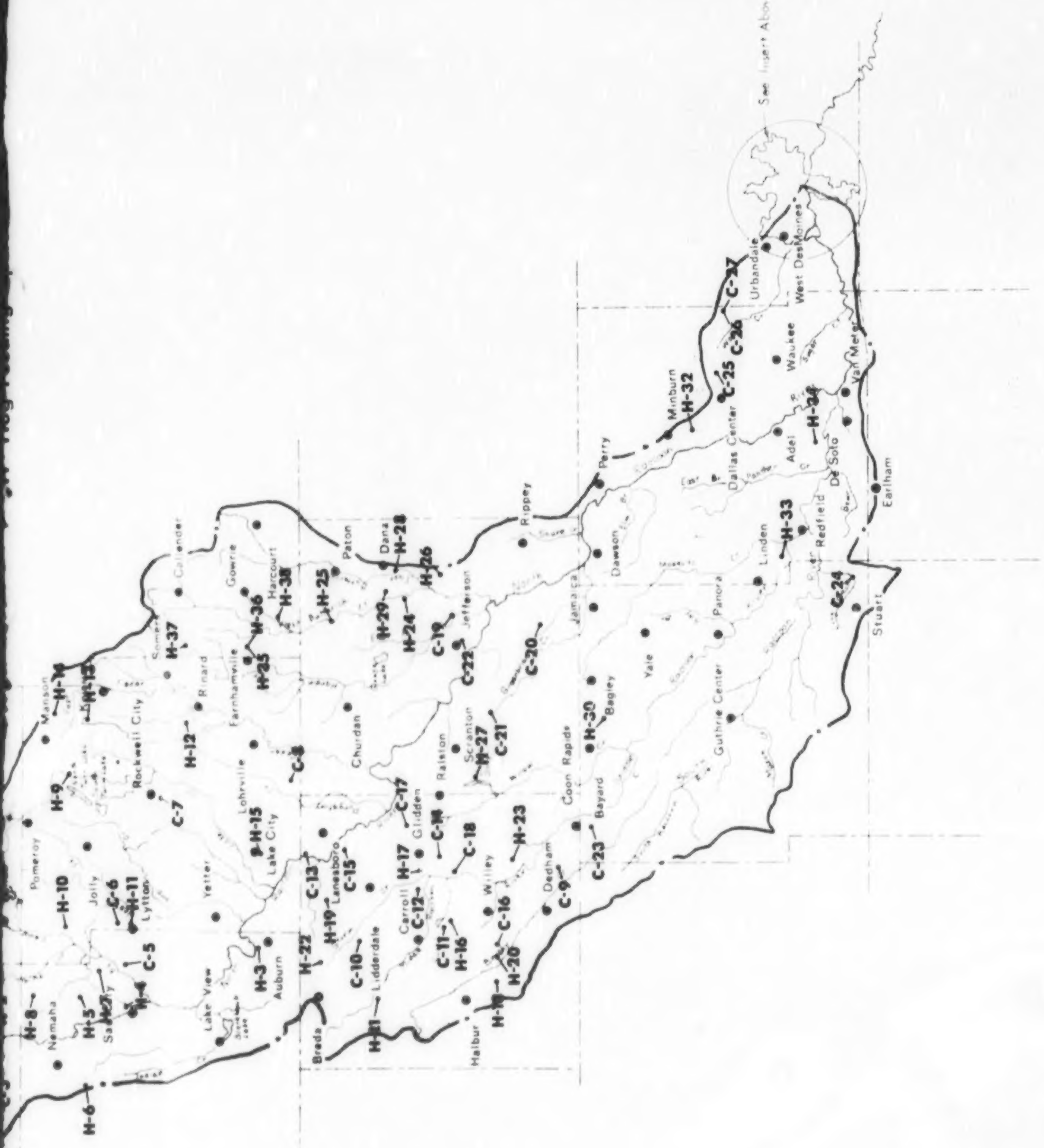

See Insert Above
Urbandale
West Des Moines
C-27
C-26
C-25
Waukee
Van Meter
Minburn
H-32
H-34
Dallas Center
Adel
De Soto
Earlham
Perry
Redfield
H-33
Linden
Rippey
Dana
H-28
Paton
H-26
Dawson
C-24
Stuart
Callender
Gowrie
Harcourt
H-38
H-25
H-36
H-29
H-24
C-19
Jefferson
Panora
Jamaica
Somers
H-37
H-35
C-22
C-20
Yale
Manson
H-14
H-13
Rinard
Farnhamville
Rockwell City
H-12
Churdan
Scranton
H-27
C-21
Bagley
H-30
Guthrie Center
Coon Rapids
Ralston
C-8
H-9
C-7
Lohrville
H-15
Lake City
C-17
C-14
Glidden
C-18
H-23
Bayard
C-23
Pomeroy
H-10
Jolly
C-6
H-11
Lytton
Yetter
C-13
Lanesboro
C-15
H-17
Carroll
C-12
Willey
Dedham
C-9
H-19
C-16
C-5
H-3
Auburn
H-22
C-10
C-11
H-16
H-20
H-8
H-5
Sac City
H-4
Lake View
Nemaha
Breda
H-21
Lidderdale
Halbur
H-18
H-6

FIGURE VII

TABLE VII-9

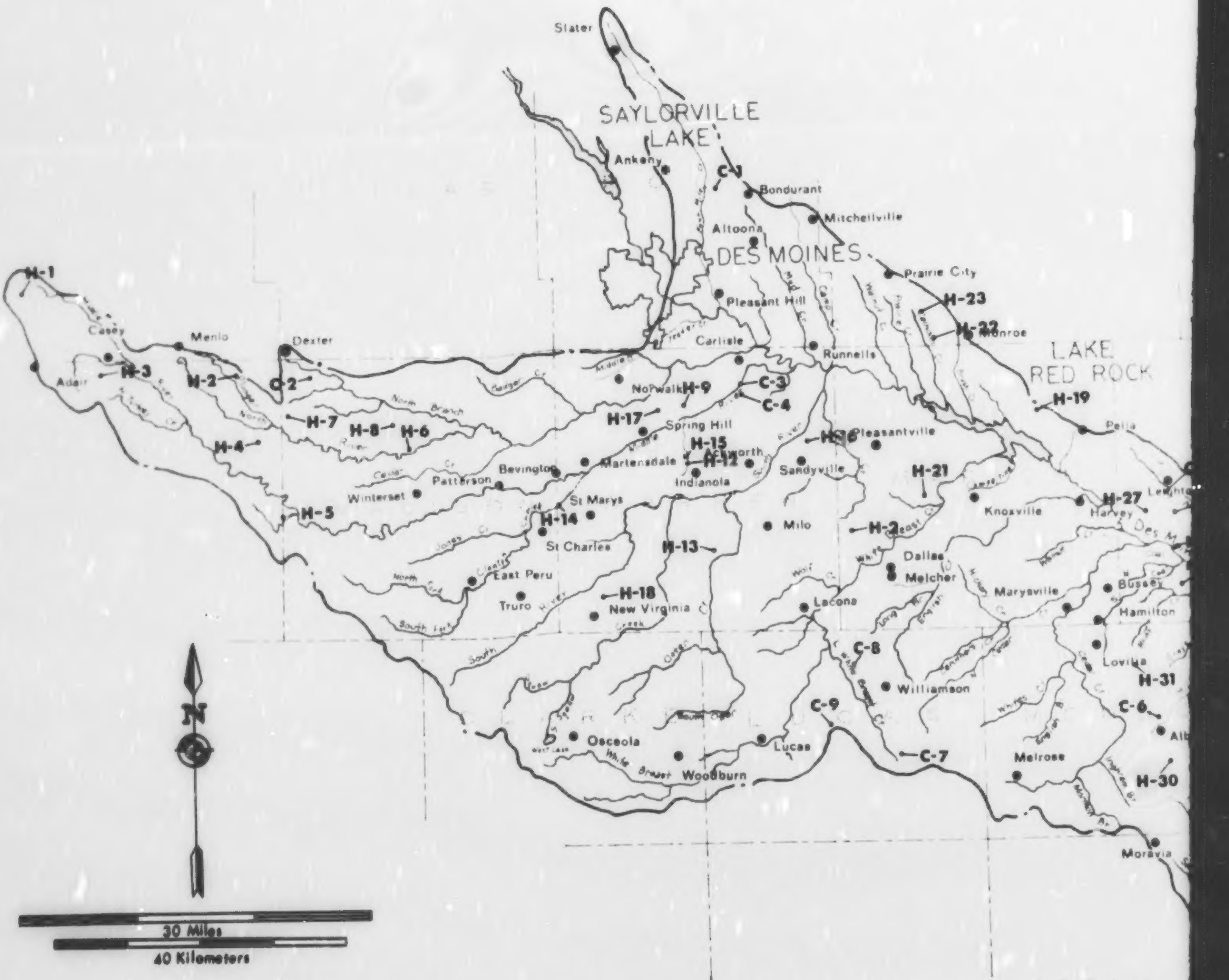
ANIMAL FEEDING OPERATIONS; RACCOON SUBBASIN

Registration No.	County	No. Of Animals	Ref. No.	Type Controls*
HOG FEEDING OPERATIONS				
2-11-00-4-01	Buena Vista	325	H- 1	ST
" 03		282	H- 2	ST
2-13-00-4-01	Calhoun	260	H- 9	ST
" 02		320	H-10	ST
" 03		NA	H-11	NA
" 04		400	H-12	ST
" 05		425	H-13	ST
" 06		400	H-14	ST
" 07		500	H-15	ST
2-14-00-4-01	Carroll	400	H-16	ST
" 02		400	H-17	NC
" 05		20	H-18	ST
" 06		240	H-19	ST
" 07		350	H-20	ST
" 08		600	H-21	ST
" 09		2,660	H-22	ST
" 10		495	H-23	ST
2-25-00-4-01	Dallas	24	H-31	ST
" 02		24	H-32	ST
" 03		400	H-33	ST
: 04		300	H-34	ST
2-37-00-4-01	Greene	414	H-24	ST
" 02		150	H-25	RC
" 03		480	H-26	ST
" 04		1,370	H-27	SL
" 05		560	H-28	ST
" 06		1,000	H-29	ST
2-39-00-4-02	Guthrie	4,130	H-30	SL
2-81-00-4-01	Sac	260	H- 3	SL
" 02		560	H- 4	SL
" 03		360	H- 5	RC
" 04		2,660	H- 6	SL
" 06		350	H- 7	ST
" 07		502	H- 8	RC

TABLE VII-9

Registration No.	County	No. Of Animals	Ref. No.	Type Controls*
2-94-00-4-02	Webster	216	H-35	ST
" 04		190	H-36	ST
" 07		24	H-37	ST
" 08		480	H-38	ST
CATTLE FEEDING OPERATIONS				
2-11-00-0-01	Buena Vista	NA	C- 1	NC
" 02		450	C- 2	RC
" 07		1,000	C- 3	RC
" 08		NA	C- 4	NC
2-13-00-0-01	Calhoun	1,500	C- 6	RC
" 02		NA	C- 7	NA
" 03		600	C- 8	SL
2-14-00-0-01	Carroll	100	C- 9	RC
" 02		600	C-10	RC
" 04		250	C-11	RC
" 05		1,000	C-12	SB
" 06		400	C-13	RC
" 07		108	C-14	ST
" 08		500	C-15	RC
" 09		NA	C-16	RC
" 10		600	C-17	NC
" 11		630	C-18	ST
2-25-00-0-01	Dallas	600	C-25	SL
"		400	C-26	ST
"		2,000	C-27	RC
2-37-00-0-01	Greene	NA	C-19	NA
" 02		NA	C-20	NA
" 03		NA	C-21	NA
" 04		NA	C-22	NA
2-39-00-0-01	Guthrie	NA	C-23	NA
" 02		300	C-24	RC
2-81-00-0-07	Sac	1,000	C- 5	RC

* SB - Storage Basin
ST - Below Building Storage - or Tank
NA - Not Available
RC - Runoff Controls
SL - Lagoon
NC - No Control


Slater
SAYLORVILLE LAKE
Ankeny
C-1
Bondurant
Mitchellville
Altoona
DES MOINES
Prairie City
H-23
H-22
Monroe
LAKE RED ROCK
Pleasant Hill
Carlisle
Runnells
H-19
Pella
H-1
Casey
Menlo
Dexter
Adair
H-3
H-2
C-2
Middle R
Norwalk
H-9
C-3
C-4
North Branch
H-7
H-8
H-6
H-4
H-17
Spring Hill
H-15
Ackworth
H-12
Martensdale
Indianola
H-16
Pleasantville
Sandyville
H-21
Knoxville
H-27
Harvey
Bevington
Patterson
Winterset
St Marys
H-14
St Charles
H-5
H-13
Milo
H-20
Dallas
Melcher
Marysville
Bussey
Hamilton
East Peru
Truro
H-18
New Virginia
Lacona
C-8
Williamson
Lovilia
H-31
C-6
Osceola
C-9
Lucas
C-7
Woodburn
White Breast
Melrose
H-30
Moravia
N
30 Miles
40 Kilometers

STATE OF IOWA

DEPARTMENT OF ENVIRONMENTAL QUALITY

DES MOINES RIVER BASIN

Lower Des Moines Subbasin

LOCATION OF REGISTERED ANIMAL FEEDING OPERATIONS

AS OF OCTOBER 1, 1974

C - Cattle Feeding Operation

H - Hog Feeding Operation

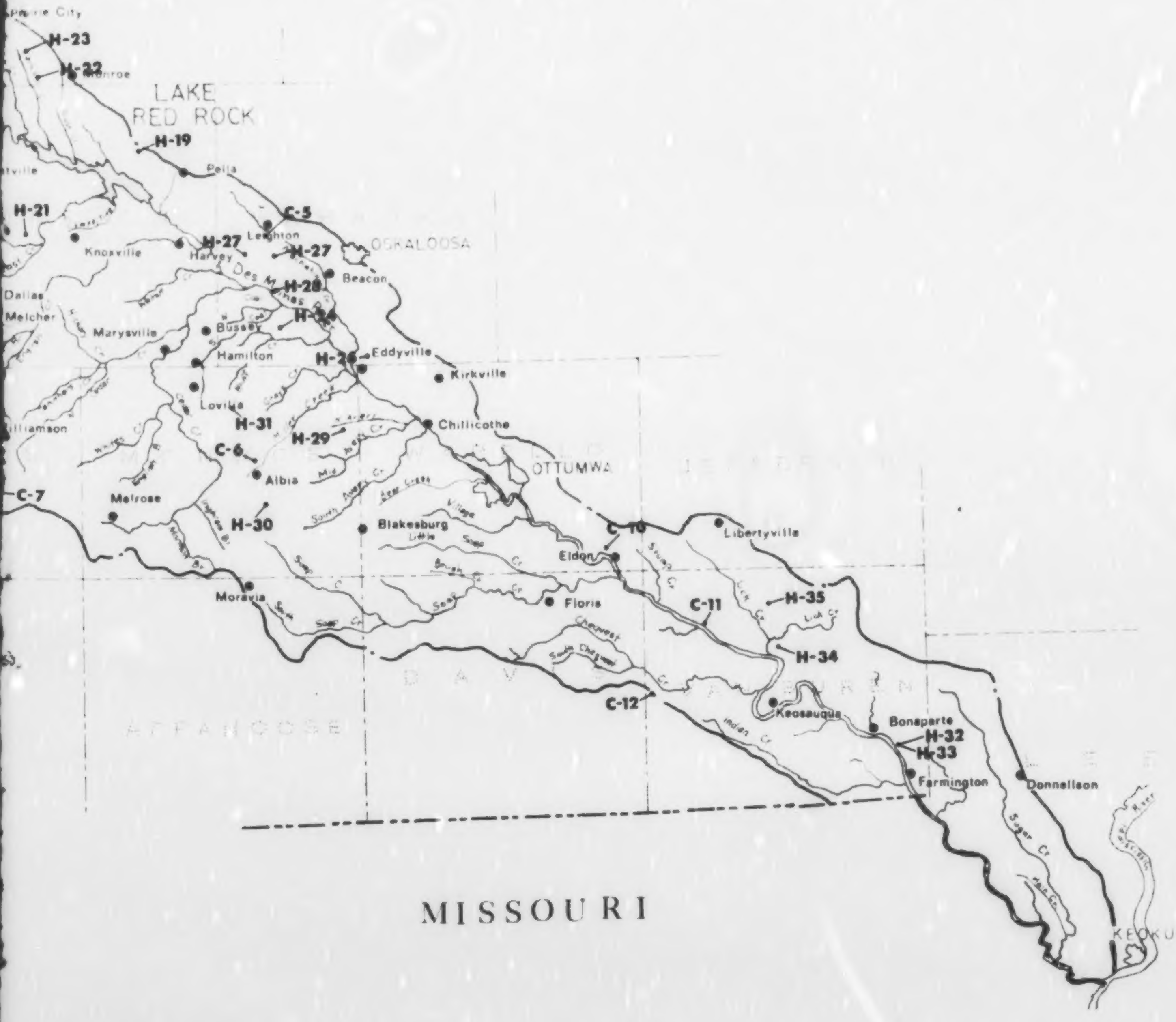

Prairie City
H-23
H-22
Monroe
LAKE RED ROCK
H-19
Pella
H-21
Knoxville
C-5
Leighton
H-27
Harvey
H-27
OSKALOOSA
Beacon
Des Moines R
H-28
H-24
Dallas
Melcher
Marysville
Bussey
Hamilton
H-26
Eddyville
Kirkville
Lovilia
H-31
Chillicothe
H-29
C-6
Albia
OTTUMWA
C-7
Melrose
H-30
Blakesburg
Little Soap Cr
C-10
Eldon
Libertyville
Floris
Moravia
C-11
H-35
H-34
Chequest
South Chequest
DAVIS
C-12
VAN BUREN
Keosauqua
APPANOOSE
Indian Cr
Bonaparte
H-32
H-33
Farmington
Donnellson
LEE
Sugar Cr
KEOKUK
MISSOURI

FIGURE VII-3

TABLE VII-10

ANIMAL FEEDING OPERATIONS; LOWER DES MOINES SUBBASIN

Registration No.	County	No. Of Animals	Ref. No.	Type Controls*
HOG FEEDING OPERATIONS				
2-01-00-4-01	Adair	1,400	H- 2	SL
" 03		NA	H- 3	NA
" 04		250	H- 4	ST
2-39-00-4-01	Guthrie	300	H- 1	RC
2-50-00-4-04	Jasper	980	H-22	ST
" 06		630	H-33	ST
2-61-00-4-01	Madison	515	H- 5	RC
" 02		400	H- 6	ST
" 03		500	H- 7	ST
" 04		560	H- 8	ST
2-62-00-4-01	Mahaska	900	H-24	SL
" 06		320	H-25	ST
" 12		480	H-26	ST
" 13		400	H-27	ST
" 14		300	H-28	ST
2-63-00-4-01	Marion	400	H-18	ST
" 02		400	H-19	ST
" 03		1,306	H-20	ST
" 04		NA	H-21	NC
2-68-00-4-01	Monroe	752	H-29	SL
" 02		2,500	H-30	SL
" 03		440	H-31	SL
2-89-00-4-01	Van Buren	3,000	H-32	SL
" 01		1,250	H-33	SL
" 02		400	H-34	ST
" 03		250	H-35	ST
2-91-00-4-01	Warren	250	H- 9	ST
" 02		NA	H-10	NA
" 03		NA	H-11	NA
" 04		345	H-12	ST
" 05		720	H-13	ST

TABLE VII-10

Registration No.	County	No. Of Animals	Ref. No.	Type Controls*
" 06		560	H-14	ST
" 07		320	H-15	ST
" 08		350	H-16	ST
" 09		382	H-17	ST
	CATTLE FEEDING OPERATIONS			
2-56-00-0-03	Lee	100	C-12	RC
2-59-00-0-01	Lucas	700	C- 7	RC
" 02		500	C- 8	RC
" 04		NA	C- 9	NA
2-61-00-0-01	Madison	NA	C- 2	NA
2-62-00-0-02	Mahaska	100	C- 5	RC
2-68-00-0-01	Monroe	NA	C- 6	NA
2-77-00-0-01	Polk	680	C- 1	ST
2-89-00-0-01	Van Buren	750	C-11	RC
2-90-00-0-01	Wapello	1,300	C-10	NC
2-91-00-0-01	Warren	48	C- 3	SL
" 02		300	C- 4	RC

* SB - Storage Basin
SL - Lagoon
RC - Runoff Controls
ST - Below Building Storage - or Tank
NC - No Control
NA - Not Available

indicated in Tables VII-8, VII-9, and VII-10, there are 72 registered feeding operations with a cumulative capacity for 41,813 cattle. The remaining 640,871 cattle in the study area are dispersed throughout the basin. Similar dispersion of the swine, sheep and poultry populations occurs in the basin. Because of the areal distribution of animals, somewhat misleading conclusions could result from a projection of total pollution potential for each watershed.

Animal Feeding Operation Pollution Abatement Costs

In order to indicate the relative magnitude of treatment costs for feeding operations in the basin, capital cost estimates have been developed for treatment systems for both cattle and swine operations. Most registered feeding operations in the basin presently have adequate treatment facilities. For purposes of this cost estimate, it is, therefore, necessary to approximate the number of unregistered beef cattle and swine which are in confined feeding operations that require treatment facilities. Testimony given before a U. S. House of Representative subcommittee (1) estimates that 22 percent of the hog operations and 26 percent of the beef cattle feeding operations in the United States have pollution problems requiring remedial measures. Treatment costs presented in Table VII-11 reflect the above percentages of unregistered animals in the basin and treatment costs from the EPA (2).

No treatment costs are provided for sheep since no confined sheep feeding operations are identified in the basin. Most

TABLE VII-11

LIVESTOCK TREATMENT COST*

Hydrologic Unit	Capital Cost Cattle	 Swine	 Total
Main Stem Upper Des Moines River	$ 278,212	$ 575,761	$ 853,973
Boone River	148,000	686,000	834,000
East Fork Des Moines River	293,000	882,000	1,175,000
West Fork Des Moines River	335,000	602,000	937,000
Lizzard Creek	98,000	259,000	357,000
Raccoon River	1,169,739	2,848,426	4,018,165
Main Stem Lower Des Moines River	455,068	2,920,317	3,375,385
Total	$2,777,019	$8,773,504	$11,550,523

* 1974 Dollars

poultry in the basin are located in a relatively small number of large egg-laying or turkey raising operations. Waste handling facilities are normally taken into consideration during the design of the operation, and most facilities presently spread the dry waste on agricultural land. For these reasons, no costs have been determined for poultry operations.

URBAN RUNOFF

In urbanized areas, surface runoff and combined sewer overflows can adversely affect the utility of the water resource. Contaminants discharged to a watercourse are the result of debris, animal droppings, eroded soil, tire and vehicular exhaust residues, deicing compounds, pesticides, fertilizers, air pollution fallout, and decayed vegetation contained in the urban runoff. These materials can be discharged into the stream during periods of precipitation or snow melt.

The impact of urban runoff upon the aquatic environment is difficult to quantify based upon present information. In addition to having little data in the basin identifying specific pollution contributions and the resulting impact from urban runoff, available technical literature has not resolved the impact of these sources upon streams.

Corrective measures applicable for urban storm-water runoff pollution abatement may be classified as preventive or curative. Preventive practices may consist of proper conservation techniques on land development projects to reduce sediment erosion. Also, improved collection of material through normal municipal street cleaning operations should reduce the waste load that currently reaches the streams. Curative solutions may require substantial physical facilities and result in large capital expenditures.

Generalized cost curves which were developed for the 1974 Survey of

Needs of Municipal Wastewater Treatment Facilities were used to give an indication of the cost to treat and/or control urban storm water runoff in the basin. The curves were based upon a composite of local consulting engineers' estimates for treating urban runoff. The cost estimate developed for the Des Moines River Basin, and found in Table VII-12, exceeded 767 million dollars.

TABLE VII-12

URBAN STORMWATER TREATMENT AND/OR CONTROL COSTS

Hydrologic Unit	Cost*
Blue Earth	$ 1,500,000
West Fork Des Moines	$ 24,540,000
East Fork Des Moines	$ 19,180,000
Upper Des Moines	$539,650,000
Raccoon	$ 67,565,000
Lower Des Moines	$116,365,000
Total	$767,300,000

* 1974 Dollars

REFERENCES

1. "Control of Pollution from Animal Feedlots." A hearing before a subcommittee of the Committee on Government Operations, House of Representatives, 93rd Congress, November 29-30, 1973.

2. David, M. L., Selter, R. E., and Eickhoff, W. D., "Economic Analysis of Proposed Effluent Guidelines-Feedlot Industry." Environmental Protection Agency, 1973.

3. Iowa Annual Farm Census, 1971, compiled by the Iowa Crop and Livestock Reporting Service, published by State of Iowa, Des Moines, Iowa.

4. Iowa Conservation Needs Inventory, Iowa Conservation Needs Committee, United States Department of Agriculture, Des Moines, Iowa, 1970. 229pp.

CHAPTER VIII - NEEDS AND COMPLIANCE SCHEDULES

ASSESSMENT OF NEEDS

Municipal Needs

The waste load allocations in Table VI-1 were compared to the present discharges (Table V-2). Facilities which could not meet their waste load allocation were evaluated as to their need for additional treatment capacity. Physical needs for effective municipal sewage control can be classified into:

1. New sewer systems and treatment facilities for certain unsewered communities.
2. Upgrading to adequate secondary treatment where the present treatment level is either primary or inadequate secondary.
3. Infiltration and/or inflow (I/I) removal.
4. Advanced treatment under selective circumstances.
5. Adequate sludge disposal.

An estimation of these needs and their associated cost has been developed for the municipalities in the Des Moines Basin. Several sources have been used to estimate costs. Some of these are listed below in order of priority.

1. Grant applications, based on preliminary engineering estimates or final construction costs.
2. 1974 Needs Survey.

3. EPA cost curves supplied for the 1974 needs survey.
4. State cost curves based on comparable construction costs.

All of the costs were updated to September, 1974, dollars based on EPA construction indices (1).

New Systems - Of the 217 incorporated municipalities in the basin, 86 do not have a sewage system. These communities are presently served by individual residence septic tanks and tile drain fields. Some of these communities have a disposal problem causing either water pollution, or a health hazard, or both. This may be caused either by old systems in need of repair or replacement, or because of unsuitable site conditions such as a high ground water table, local limestone deposits, or poor soil conditions.

Most unsewered communities have a waste water disposal problem, but whether it is cost effective to construct a sewer system and treatment plant or to replace or repair existing individual septic tank systems is difficult to estimate without a detailed engineering report.

For the purpose of this study it was assumed to be cost effective to continue using individual residence septic tank systems in those communities with projected 1990 populations of less than 200. It may also be cost-effective for certain towns with populations somewhat greater than 200 to continue the use of individual septic systems, however, increased potential for groundwater contamination and related health problems from the use of individual septic systems by larger communities must also be weighed in a cost-effectiveness evaluation. As a result, communities with projected 1990 populations greater than 200 were assumed to have a need for a sewer system and treatment facilities while communities with projected populations of less than 200 were assumed to have no needs.

Upgrade to Secondary Treatment - No communities in the Des Moines River Basin have only primary treatment. All municipal facilities provide what is commonly referred to as secondary treatment. The Act requires that all municipal treatment facilities shall, by July 1, 1977, have treatment equivalent to secondary treatment. Many municipal secondary plants, however, cannot presently, or with projected 1990 flow, meet the new EPA and DEQ definition of secondary treatment. When compared with the present quantitative definition, several municipalities are estimated to have a need to upgrade their facilities to secondary treatment.

Upgrade to Advanced Treatment -The waste load allocation analyses have pointed out several locations where treatment more stringent than secondary will be required if water quality standards are to be met. Because the new waste load allocations will be incorporated into discharge permits, several municipalities now have the need for advanced treatment facilities.

Infiltration and/or Inflow Removal - Many municipalities have infiltration and/or inflow (I/I) problems. To estimate the cost to correct I/I problems in an individual case requires detailed information concerning the systems. Without such information an accurate cost estimation is difficult. Some municipalities have been studied by consulting engineers and correction costs estimated. In addition, the 1974 Needs Survey of Municipal Wastewater Treatment Plants provides the estimated cost to study and correct I/I for a 20 percent random sampling of Iowa municipalities. For those municipalities for which an I/I correction cost estimate was available, the cost for study and correction was updated and included in the costs column of the table of needs. For those municipalities where no estimate was available for I/I correction, no costs are included because of the difficulty in making an accurate estimate without detailed information about the system. It should be realized, therefore, that the total municipal needs for the basin will be greater than what is predicted in Table VIII-5.

Most cost estimates assume that, for a given facility, it is cost effective to remove I/I rather than treat it. If it is known from engineering studies that it is cost-effective to treat I/I, those costs are included with treatment plant costs.

Sludge Disposal - Sludge disposal is a major concern at any wastewater treatment plant. A secondary municipal treatment plant produces approximately 1726 lbs. of dry solids per million gallons of water treated, or approximately 173 lbs. per 1000 people per day. When an additional contribution comes from industrial wastes, sewage sludge can become the second largest disposal problem facing a municipality, next only to garbage disposal.

Unfortunately, the job of designing a sludge disposal system, historically, seems to have been done backwards (2). The conditioning and handling design was often completed before much thought was given to actual method and site of final disposal. A more logical method of design is to first choose the final disposal method and location and then work back from that point to the most cost-effective process for getting the sludge in the best condition to accomodate the mechanics of actual disposal.

Most municipal treatment facilities in the Des Moines basin handle their sludge in similar manners. After settling to concentrate solids, the sludge is stabilized either by aerobic or anaerobic digestion. Digested sludge is then usually either dried mechanically or on drying beds and finally hauled either to a landfill or farmland.

Farmland is the more common disposal location since many landfills, because of their location or equipment, cannot accept sewage sludge either wet or dry. Currently there are twenty-two approved landfills in the Des Moines River

Basin. Therefore, many sludges are either applied to farmland or are being illegally dumped into abandoned gravel pits or unapproved landfills. Greater effort must be made to educate the public to the benefits of accepting treated sewage sludge for land application. Even though some sludges contain traces of toxic metals from plating industries making them undesirable for application to certain crops, most grain crops are not influenced by these metals and with proper controls can serve as application sites.

If weather is conducive for equipment to get into the fields wet digested sludge is often applied directly to farmlands. In fact, nearly all municipalities have sludge treatment equipment although most presently apply wet digested sludge directly to farmland allowing the sludge treatment facilities to lie idle. Drying beds, for example, often become relegated to a backup status as a method of sludge handling. This is done so as to reserve their entire capacity for the wet spring season when farm fields become inaccessable.

Land disposal of sludge has the advantage of being one of the simplest methods during winter months. It is also generally one of the most cost-effective methods.

Table VIII-1 gives an indication of sludge disposal costs found in Ohio(2).

TABLE VIII-1

AVERAGE DISPOSAL COSTS (PER TON OF DRY SOLIDS)

Sludge Handling Method	Costs*
Vaccum filters, centrifuges	$34.41
Direct land application of liquid (Hauling by contract)	31.93
Drying beds (On-site storage for private individual hauling may reduce cost)	14.34
Direct land application of liquid (By city-owned trucks)	7.73

*Costs do not include digestion.

One community in the basin is presently experimenting with a method of combined sludge and garbage composting. In this process the ultimate disposal of the sludge would be as a salable soil conditioning agent. No conclusive results are as yet available from the project.

Costs to upgrade or to add additional sludge handling capacity that may be required under the basin plan have not been estimated for the municipalities in the basin. A detailed knowledge of the existing facilities, not presently available, is needed for an accurate estimate. In many cases, the cost should be small when compared with that to upgrade the existing treatment. This is, therefore, another reason why the total municipal need for the basin will be greater than what is predicted in Table VIII-5.

Summary of Municipal Needs - Table VIII-2 is a compilation of municipal treatment facility needs for the Des Moines River Basin. In this table, projected flows are listed along with the concentration of BOD_5 and ammonia-N (NH_3-N) in the effluent. In addition either the pounds projected for the 1990 discharge or the pounds allowed by the waste load allocations (whichever is less), and a compliance schedule for meeting the waste load allocations are listed. A permit will be issued by the DEQ to the municipalities which will assure compliance with the basin plan.

Table VIII-3 summarizes the basin municipal treatment facility needs and the related investment requirements for the basin.

Table VIII-2
MUNICIPAL
ASSESSMENT OF NEEDS
AND
SCHEDULE OF COMPLIANCE***

Rank	Dischargers	Waste Load Allocation			Needs				Schedule of Compliance		
		1990 Flow**	Concentration* BOD_5/NH_3	lbs.Eff. BOD_5/NH_3	Treatment	1974 Dollars	Collection	1974 Dollars	Facility Plans	Final Plans	Completion Date
1	Estherville M- 5	2.51	10/2	209/42	advanced treatment	8,312,000 10/	none	----	Under Construction		
2	Ankeny Ind. M-154-2	0.13	30/15	33/16	To be included in M-154-1 Needs				4/1/77	4/	4/
3	Eagle Grove M- 59	0.56	30/2	140/9	upgrade to advanced STP	1,119,200 10/	upgrade sewer system	200,120 10/	7/1/75	1/1/76	7/1/76
4	Des Moines #1 M-150	40.77	10/2	3400/680	4/ advanced treatment plant	70,000,000 9/	upgrade sewer system	14,873,000 2/	4/1/77	4/	4/

* In mg/1
** In mgd
1/ At such time as deemed necessary.
2/ Collection costs include needs for all communities discharging to the Des Moines Metropolitan Sewer System as established in the 1974 Needs Survey.
3/ In accordance with 201 plan for Storm Lake.
4/ In accordance with 208 plan for Des Moines Metro Area.
5/ Not a true representative value because of lack of 201 or 208 plans.
6/ In accordance with 201 plan for Pella.
7/ In accordance with 201 plan for Oskaloosa.
8/ Cost estimates from DEQ & EPA cost curves.
9/ DEQ 1974 Need Survey.
10/ Cost values given on Grant Applications.

*** Abreviations Used include:

BOD - Biochemical Oxygen Demand
C.D. - Controled Discharge
disinf. - disinfection
D.M. - Des Moines Treatment Plant
Eff. - Effluent
F.H.A. - Federal Housing Administration
I/I - Inflow/Infiltration Analysis
lbs. - pounds
NA - Not Available
NH_3 - Ammonia Nitrogen
Pop - Population
P.S. - Partial Storage
S.D. - Sanitary District
STP - Sewage Treatment Plant

Table VIII-2 (continued)

Rank	Dischargers Ref. #	Waste Load Allocation 1990 Flow**	Concentration* BOD$_5$/NH$_3$	lbs.Eff. BOD$_5$/NH$_3$	Needs Treatment	1974 Dollars	Collection	1974 Dollars	Schedule of Compliance Facility Plans	Final Plans	Completion Date
5	Albia S.W. M-205	To Be Abandoned			----	----	----	----	----	----	----
6	Clarion M- 60	0.28	30/2	70/5	upgrade to advanced treatment	775,000 8/	none	----	2/1/77	4/1/78	12/1/79
7	Bagley M-140	0.39	30/15	10/5	complete secondary facility & disinf.	140,000 8/	none	----	1/	1/	1/
8	Bancroft M- 24	C.D.	C.D.	C.D.	three cell lagoon	394,000 10/	none	----	Under Construction		
9	Storm Lake M- 85	3.09	30/2	773/51	complete advanced STP	6,166,000 10/	lift station force main	2,765,000 8/	12/1/75	6/1/76	10/1/76
10	Whittemore M- 32	0.151	30/2	38/3	new advanced treatment plant	480,000 8/	none	----	1/1/76	7/1/76	1/1/78
11	Ankeny S.W. M-154-1	1.707	30/15	427/213	new plant 4/ I/I	3,494,000 9/	sewers	353,000 9/	4/1/77	4/	4/
12	Emmetsburg M- 9	0.55	10/2	45/9	advanced treatment	1,835,200 10/	sewer improvement	225,900 10/	Under Construction		
13	Prairie City M-185	0.14	30/15	35/17	none	----	none	----	----	6/6/74	----

Table VIII-2 (continued)

Rank	Dischargers Ref. #	Waste Load Allocation			Needs				Schedule of Compliance		
		1990 Flow**	Concentration* BOD_5/NH_3	lbs.Eff. BOD_5/NH_3	Treatment	1974 Dollars	Collection	1974 Dollars	Facility Plans	Final Plans	Completion Date
14	Eddyville M-207	C.D.	C.D.	C.D.	third lagoon cell	8/ 106,000	none	----	1/	1/	1/
15	Webster City M- 62	2.06	30/2	515/34	complete advanced STP & I/I	9/ 2,055,000	lift station	9/ 947,000	----	1/1/76	11/1/77
16	Boone M- 68	2.407	30/5	602/100	complete advanced treatment plant	9/ 5,264,000	sewers, lift station, force main	9/ 2,027,000	10/1/75	10/1/76	12/1/78
17	Sac City M- 87	0.28	30/2	70/5	upgrade to advanced treatment	10/ 652,390	upgrade sewer system	10/ 46,800	----	12/1/75	8/1/77
18	Panora M-138	C.D.	C.D.	C.D.	third lagoon cell	8/ 108,000	none	----	1/	1/	1/
19	Fort Dodge M- 45	4.322	30/4	1081/144	advanced treatment. plant under const.		none	----		Under Construction	
20	Goldfield M- 57	C.D.	C.D.	C.D.	const. two lagoon cell	8/ 93,000	none	----	1/	1/	1/
21	Laurens M- 89	0.16	30/2	40/3	upgrade to secondary, NH_3 & disinf.	8/ 223,000	none	----	7/1/76	1/1/77	11/1/78

Table VIII-2 (continued)

Rank	Dischargers Ref. #	Waste Load Allocation			Needs				Schedule of Compliance		
		1990 Flow**	Concentration* BOD$_5$/NH$_3$	lbs.Eff. BOD$_5$/NH$_3$	Treatment	1974 Dollars	Collection	1974 Dollars	Facility Plans	Final Plans	Completion Date
22	Fonda M- 91	0.093	30/2	23/2	upgrade to advanced, NH$_3$ & disinf.	158,000 8/	none	----	9/1/75	4/1/76	10/1/77
23	Rockwell City M- 99	0.277	30/7	69/16	upgrade to advanced. NH$_3$ disinf. and I/I	166,000 8/	none	----	1/1/76	7/1/76	8/1/78
24	Albia N. M-206	0.496	30/15	124/62	upgrade to secondary treatment	1,159,000 9/	upgrade sewer system	923,000 9/	----	5/1/76	9/1/77
25	Polk City M- 71	C.D.	C.D.	C.D.	I/I correction	400,000 9/	none	----	7/1/76 (I/I)	4/1/77 (Facility Plan)	
26	Donnellson M-219	0.111	10/2	9/2	advanced treatment plant	450,000 8/	none	----	1/1/76	9/1/76	12/1/77
27	Bondurant M-175	4/	C.D.	4/	4/ I/I add third cell	284,000 9/	upgrade sewer system	808,000 9/	7/1/76 (I/I)	4/1/77 (Facility Plans)	
28	Adel M-124	0.224	30/15	56/28	upgrade to secondary treatment I/I & disinf.	131,000 8/	----	----	10/1/76	8/1/77	10/1/78

Table VIII-2 (continued)

Rank	Dischargers Ref. #	Waste Load Allocation			Needs				Schedule of Compliance		
		1990 Flow**	Con entration* BOD_5/NH_3	lbs.Eff. BOD_5/NH_3	Treatment	1974 Dollars	Collection	1974 Dollars	Facility Plans	Final Plans	Completion Date
29	Winterset M-166	0.446	10/3	37/11	upgrade to advanced treatment	394,000 8/	none	----	1/1/76	7/1/76	11/1/77
30	Britt M- 52	0.230	30/2	58/4	new advanced treatment plant, (nitrification) I/I	675,000 8/	lift station force main and sewer	526,000 9/	1/1/77	11/1/77	4/1/79
31	Slater M-152	C.D.	C.D.	C.D.	third lagoon cell	175,000 8/	none	----	12/1/75	9/1/76	11/1/77
32	Lake View M- 93	0.229	30/4	57/8	upgrade to advanced nitrification and disinf.	120,000 8/	none	----	2/1/77	2/1/78	12/1/79
33	Ogden M- 73	.176	30/15	44/22	upgrade to secondary treatment, disinf., I/I	200,000 8/	none	----	5/1/77	3/1/78	11/1/79
34	Kanawha M- 56	C.D.	C.D.	C.D.	third lagoon cell	100,000 8/	none	----	1/	1/	1/
35	Jefferson M-109	0.606	30/6	152/30	complete advanced STP	967,600 10/	interceptor and lift	170,950 10/	---	---	12/1/77
36	Pella S.W. M-192	6/	6/	6/	6/		6/		6/1/76	2/1/77	12/1/78

Table VIII-2 (continued)

Rank	Dischargers Ref. #	Waste Load Allocation			Needs				Schedule of Compliance		
		1990 Flow**	Concentration* BOD_5/NH_3	lbs.Eff. BOD_5/NH_3	Treatment	1974 Dollars	Collection	1974 Dollars	Facility Plans	Final Plans	Completion Date
37	Dayton M- 64	0.174	30/15	44/22	upgrade to secondary treatment	260,000 8/	none	----	8/1/76	6/1/77	10/1/78
38	Farnhamville M-110	C.D.	C.D.	C.D.	third lagoon cell	81,000 8/	none	----	1/	1/	1/
39	Perry M-121	1.378	30/2	345/23	complete advanced STP	1,950,000 8/	none	----	12/1/75	9/1/76	4/1/78
40	Glidden M-135	0.068	30/15	17/8	upgrade to secondary treatment & disinf.	105,000 8/	none	----	6/1/76	1/1/77	9/1/78
41	Graettinger M- 8	C.D.	C.D.	C.D.	third lagoon cell and I/I	110,000 8/	none	----	1/	1/	1/
42	Des Moines Highland Hill M-151	4/	4/	4/	4/	4/	I/I	978,000 9/	7/1/76 (I/I)	4/1/77 (Facility Plan)	
43	Gowrie M-113	0.081	30/15	20/10	upgrade to meet secondary treat. & I/I	40,000 8/	none	----	1/	1/	1/
44	Rolfe M- 17	C.D.	C.D.	C.D.	third lagoon cell	100,000 9/	none	----	1/	1/	1/

Table VIII-2 (continued)

Rank	Dischargers Ref. #	Waste Load Allocation			Needs				Schedule of Compliance		
		1990 Flow**	Concentration* BOD_5/NH_3	lbs.Eff. BOD_5/NH_3	Treatment	1974 Dollars	Collection	1974 Dollars	Facility Plans	Final Plans	Completion Date
45	Corwith M- 51	C.D.	C.D.	C.D.	third lagoon cell	113,000 9/	none	----	1/	1/	1/
46	Melcher M-193	C.D.	C.D.	C.D.	third lagoon cell	105,000 8/	none	----	1/	1/	1/
47	Pocahontas M- 40	0.325	30/15	81/41	upgrade to secondary treatment & I/I	112,000 8/	none	----	----	7/1/76	2/1/78
48	West Bend M- 13	0.076	30/15	19/10	secondary plant	337,000 9/	inter-ceptor	88,000 9/	1/	1/	1/
49	Lake City S.W. M-101	0.084	30/7	21/5	upgrade to secondary, NH_3 and disinf.	330,000 8/	none	----	----	1/1/77	9/1/78
50	Scranton M-108	0.065	30/15	16/8	upgrade to secondary treat. & disinf.	158,000 8/	none	----	2/1/77	11/1/77	7/1/79
51	Breda M-130	C.D.	C.D.	C.D.	third lagoon cell, I/I	121,000 9/	none	----	1/	1/	1/

Table VIII-2 (continued)

		Waste Load Allocation			Needs				Schedule of Compliance		
Rank	Dischargers Ref. #	1990 Flow**	Concentration* BOD_5/NH_3	lbs.Eff. BOD_5/NH_3	Treatment	1974 Dollars	Collection	1974 Dollars	Facility Plans	Final Plans	Completion Date
52	Des Moines Area "C" M-222	4/	4/	4/	4/	4/	upgrade sewer system	31,000 9/	7/1/76 (I/I)	4/1/77 (Facility Plan)	
53	Ankeny E. M-153	2.992	30/15	749/375	4/ new facility just completed	---	upgrade sewer system	1,430,000 10/	---	---	---
54	Knoxville M-191	0.88	30/15	221/111	I/I	7,800 10/	upgrade sewer system	205,600 10/	1/	1/	1/
55	Altoona M-155	1.513	30/15	379/189	4/ complete secondary plant	955,000 8/	upgrade sewer system	102,000 8/	7/1/76 (I/I)	4/1/77 (Facility Plan)	
56	Pleasant Hill M-156	0.220	30/15	55/28	4/ I/I	406,000 9/	upgrade sewers	1,058,000 9/	7/1/76 (I/I)	4/1/77 (Facility Plan)	
57	Mitchellville M-184	0.176	30/15	44/22	upgrade to secondary treatment	40,000 8/	none	----	4/1/77	1/	1/
58	Monroe S.W. M-225	C.D.	C.D.	C.D.	two lagoon cells	80,000 9/	none	----	8/1/76	6/1/77	12/1/78

Table VIII-2 (continued)

Rank	Dischargers	Waste Load Allocation			Needs				Schedule of Compliance		
		1990 Flow**	Concentration* BOD_5/NH_3	BOD_5/NH_3 lbs.Eff.	Treatment	1974 Dollars	Collection	1974 Dollars	Facility Plans	Final Plans	Completion Date
59	Runnells M-176	.048	30/15	12/6 4/	4/complete secondary STP & disinf.	175,000 8/	complete sewer system	460,000 8/	1/	1/	1/
60	Allemen M-227	.024	C.D.		three cell lagoon	85,000 8/	complete sewer system	300,000 8/	4/1/77	1/	1/
61	Madrid M- 70	.259	30/15	65/32	upgrade to secondary treatment & I/I	292,000 8/	new collection system	29,000 8/	1/	1/	1/
62	Stratford M- 63	0.07	30/15	18/9	upgrade to secondary treatemnt & I/I	21,000 8/	none	----	1/	1/	1/
63	Sheldahl M-221	----will go to Slater M-152----			----	----	complete sewer system	380,000 8/	1/	1/	1/
64	Boxholm M- 66	C.D.	C.D.	C.D.	three cell lagoon	85,000 8/	complete sewer system	305,000 8/	Under Construction		
65	Pilot Mound M- 67	C.D.	C.D.	C.D.	three cell lagoon	67,900 10/	complete sewer system	100,900 10/	1/	1/	1/
66	Luther M- 69	----	----	----	maintain septic tanks	----	none	----			

Table VIII-2 (continued)

Rank	Dischargers Ref. #	Waste Load Allocation			Needs				Schedule of Compliance		
		1990 Flow**	Concentration* BOD_5/NH_3	lbs.Eff. BOD_5/NH_3	Treatment	1974 Dollars	Collection	1974 Dollars	Facility Plans	Final Plans	Completion Date
67	Earlham M-143	C.D.	C.D.	C.D.	third lagoon cell	105,000 8/	none	---	6/1/76	2/1/77	1/1/78
68	Burt M- 25	C.D.	C.D.	C.D.	third lagoon cell	90,000 8/	none	----	1/	1/	1/
69	Titonka M- 26	0.057	30/15	14/7	upgrade to secondary	40,000 8/	none	----	4/1/77	2/1/78	6/1/79
70	Indianola N. M-174	1.034	10/2	86/17	new advanced STP, I/I	3,150,000 10/	new collectors, new interceptors	2,012,000 10/	10/1/75	4/1/76	12/1/77
71	Lytton M- 96	C.D.	C.D.	C.D.	none	----	none	----			
72	Carroll M-131	1.075	30/5	269/45	upgrade with NH_3 removal	338,000 10/	outfall sewer	216,800 10/	7/1/76	1/1/77	4/1/78
73	Oskaloosa S.W. M-204	0.807	30/15	202/101	7/	----	7/	----	7/	7/	7/
74	Oskaloosa S. M-203	0.09	30/15	23/11	7/	----	7/	----	7/	7/	7/
75	Beacon M-202	C.D.	C.D.	C.D.	third lagoon cell	78,000 8/	none	----	1/	1/	1/

Table VIII-2 (continued)

Rank	Dischargers Ref. #	Waste Load Allocation			Needs				Schedule of Compliance		
		1990 Flow**	Concentration* BOD_5/NH_3	lbs. Eff. BOD_5/NH_3	Treatment	1974 Dollars	Collection	1974 Dollars	Facility Plans	Final Plans	Completion Date
76	Lovilia M-198	C.D.	C.D.	C.D.	third lagoon cell	90,000 8/	none	----	1/	1/	1/
77	Bussey M-200	C.D.	C.D.	C.D.	two lagoon cells	86,000 8/	none	----	1/	1/	1/
78	Dallas M-174	To Melcher M-193			none	----	upgrade sewer system	500,000 9/	1/	1/	1/
79	Kirkville M-208	0.028	30/15	7/4	complete secondary STP	128,000 9/	complete sewer system	281,000 9/	1/	1/	1/
80	Harvey M-195	0.024	30/15	6/3	complete secondary STP	83,000 8/	complete sewer system	300,000 8/	1/	1/	1/
81	Hamilton M-199	C.D.	C.D.	C.D.	three cell lagoon	84,000 9/	sewer system	234,000 9/	1/	1/	1/
82	Chillicothe M-209	----	----	----	maintain septic tanks	----	none	----			
83	Lake City N. M-100	0.095	30/7	24/6	upgrade to advanced, NH_3 & disinf.	159,000 8/	none	----	----	1/1/77	9/1/78

Table VIII-2 (continued)

Rank	Dischargers Ref. #	Waste Load Allocation			Needs				Schedule of Compliance		
		1990 Flow**	Concentration* BOD_5/NH_3	lbs.Eff. BOE_5/NH_3	Treatment	1974 Dollars	Collection	1974 Dollars	Facility Plans	Final Plans	Completion Date
84	Renwick M- 55	C.D.	C.D.	C.D.	add two lagoon cells	8/ 162,000	none	----	1/	1/	1/
85	Wesley M- 53	C.D.	C.D.	C.D.	three cell lagoon	8/ 180,000	complete sewer system	8/ 510,000	Under Construction		
86	Luverne M- 54	C.D.	C.D.	C.D.	three cell lagoon	10/ 236,700	sewers	10/ 203,100	1/	1/	1/
87	Woolstock M- 61	C.D.	C.D.	C.D.	three cell lagoon	10/ 410,830	complete sewer system	10/ 234,000	Under Construction		
88	Thor M- 58	C.D.	C.D.	C.D.	three cell lagoon	8/ 81,000	complete sewer system	8/ 280,000	----	----	----
89	Gilmore City M- 41	C.D.	C.D.	C.D.	third lagoon cell & I/I	9/ 140,000	additional sewer	9/ 24,000	1/	1/	1/
90	Humboldt M- 20	0.926	30/9	232/68	advanced treatment	9/ 1,085,000	none	----	6/1/76	12/1/76	12/1/77
91	Mallard M- 15	C.D.	C.D.	C.D.	three cell lagoon just completed	----	none	----	----	----	----
92	Bode M- 33	C.D.	C.D.	C.D.	third lagoon cell	8/ 79,000	none	----	1/	1/	1/

Table VIII-2 (continued)

Rank	Dischargers	Waste Load Allocation			Needs				Schedule of Compliance		
		1990 Flow**	Concentration* BOD_5/NH_3	lbs.Eff. BOD_5/NH_3	Treatment	1974 Dollars	Collection	1974 Dollars	Facility Plans	Final Plans	Completion Date
93	Wallingford M- 7	C.D.	C.D.	C.D.	three cell lagoon	8/ 82,500	complete sewer system	8/ 300,000	1/	1/	1/
94	Ayrshire M- 10	C.D.	C.D.	C.D.	three cell lagoon	9/ 96,000	complete sewer system	9/ 489,000	1/	1/	1/
95	Rutland M- 19	C.D.	C.D.	C.D.	three cell lagoon	10/ 81,000	complete sewer system	10/ 236,000	Under Construction		
96	Gruver M- 6	C.D.	C.D.	C.D.	three cell lagoon	10/ 71,800	complete sewer system	10/ 120,000	1/	1/	1/
97	Cylinder M- 11	C.D.	C.D.	C.D.	three cell lagoon	10/ 82,400	complete sewer system	8/ 63,500	1/	1/	1/
98	Waukee M-146	C.D.	C.D.	C.D.	none	----	none	----	4/1/77	----	----
99	Dallas Center M-123	0.258	30/15	65/32	upgrade to secondary treatment	8/ 20,000	none	----	6/1/76	3/1/77	7/1/78
100	Van Meter M-145	C.D.	C.D.	C.D.	third lagoon cell	9/ 98,000	sewers	9/ 162,000	1/	1/	1/
101	Osceola E. M-186-1	NA	NA	NA	Engineer Plans to Abandon Plant				----	----	----
102	Badger M- 38	C.D.	C.D.	C.D.	third lagoon cell	8/ 85,000	none	----	1/	1/	1/

Table VIII-2 (continued)

Rank	Dischargers	Waste Load Allocation 1990 Flow**	Waste Load Allocation Concentration* BOD_5/NH_3	Waste Load Allocation lbs.Eff. BOD_5/NH_3	Needs Treatment	Needs 1974 Dollars	Needs Collection	Needs 1974 Dollars	Schedule of Compliance Facility Plans	Schedule of Compliance Final Plans	Schedule of Compliance Completion Date
103	Clare M- 42	C.D.	C.D.	C.D.	three cell lagoon	88,000 9/	sewer lift station interceptor	356,000 9/	Under Construction		
104	Moorland M- 44	0.031	30/15	8/4	secondary treatment	131,000 9/	complete sewer system	319,000 9/	1/	1/	1/
105	Havelock M- 39	0.026	30/15	7/4	secondary treatment	136,000 9/	complete sewer system	398,000 9/	1/	1/	1/
106	Palmer M-225	0.028	30/15	7/4	secondary treatment	88,000 8/	sewer system	330,000 8/	1/	1/	1/
107	Barnum M- 43	C.D.	C.D.	C.D.	three cell lagoon	146,100 10/	complete sewer system	176,200 10/	Under Construction		
108	Pomeroy M- 98	C.D.	C.D.	C.D.	third lagoon cell	98,000 8/	none	----	1/	1/	1/
109	Otho M- 47	C.D.	C.D.	C.D.	third lagoon cell	91,000 8/	none	----	1/	1/	1/
110	Lehigh M- 48	C.D.	C.D.	C.D.	third lagoon cell, I/I	143,000 9/	additional sewers	100,000 9/	1/	1/	1/
111	Savage S.D. M- 46	C.D.	C.D.	C.D.	third lagoon cell	88,000 8/	none	----	1/	1/	1/
112	Duncombe M- 50	C.D.	C.D.	C.D.	third lagoon cell	82,000 8/	none	----	1/	1/	1/

Table VIII-2 (continued)

Rank	Dischargers Ref. #	Waste Load Allocation			Needs				Schedule of Compliance		
		1990 Flow**	Concentration* BOD_5/NH_3	lbs.Eff. BOD_5/NH_3	Treatment	1974 Dollars	Collection	1974 Dollars	Facility Plans	Final Plans	Completion Date
113	Vincent M- 49	C.D.	C.D.	C.D.	third lagoon cell	67,000[8]	none	----	1/	1/	1/
114	De Soto M-144	C.D.	C.D.	C.D.	third lagoon cell	88,000[8]	none	----	1/	1/	1/
115	Manson M-103	C.D.	C.D.	C.D.	third lagoon cell	156,000[9]	none	----	1/	1/	1/
116	Auburn M- 94	C.D.	C.D.	C.D.	three cell lagoon	92,000[8]	complete sewer system	375,000[8]	1/	1/	1/
117	Lanesboro M-102	C.D.	C.D.	C.D.	three cell lagoon	81,000[8]	complete sewer system	280,000[8]	1/	1/	1/
118	Somers M-105	----	----	----	maintain septic tanks	----	none	----	1/	1/	1/
119	Rinard M-106	0.008	30/15	2/1	complete secondary facility	52,000[8]	additional sewers	----	1/	1/	1/
120	Albert City M- 82	0.085	30/8	21/6	ammonia reduction plant upgrade, disinf. & I/I	90,000[8]	none	----	11/1/75	9/1/76	3/1/78

Table VIII-2 (continued)

Rank	Dischargers Ref. #	Waste Load Allocation			Needs				Schedule of Compliance		
		1990 Flow**	Concentration* BOD_5/NH_3	lbs.Eff. BOD_5/NH_3	Treatment	1974 Dollars	Collection	1974 Dollars	Facility Plans	Final Plans	Completion Date
121	Rembrandt M- 81	C.D.	C.D.	C.D.	third lagoon cell	96,000 9/	none	----	1/	1/	1/
122	Marathon M- 80	.047	30/8	12/3	new advanced (NH_3 removal)	255,000 8/	complete sewer system	460,000 8/	1/	1/	1/
123	Lakeside M- 86	3/	3/	3/	3/	----	3/	----	3/	3/	3/
124	Ottumwa M-210	7.14	30/15	1786/893	none	----	none	----			
125	Eldon M-211	C.D.	C.D.	C.D.	third lagoon cell	93,000 8/	none	----	1/1/77	1/1/78	3/1/79
126	Keosauqua M-216	C.D.	C.D.	C.D.	third lagoon cell	107,000 8/	none	----	1/	1/	1/
127	Moravia M-212	C.D.	C.D.	C.D.	third lagoon cell	93,000 8/	none	----	1/	1/	1/
128	Farmington M-218	C.D.	C.D.	C.D.	three cell lagoon	957,400 10/	complete sewer system	439,700 10/	Under Construction		
129	Bonaparte M-217	C.D.	C.D.	C.D.	three cell lagoon completed	----	none	----	Completed		

Table VIII-2 (continued)

Rank	Dischargers Ref. #	Waste Load Allocation			Needs				Schedule of Compliance		
		1990 Flow**	Concentration* BOD_5/NH_3	lbs.Eff. BOD_5/NH_3	Treatment	1974 Dollars	Collection	1974 Dollars	Facility Plans	Final Plans	Completion Date
130	Blakesburg M-213	C.D.	C.D.	C.D.	three cell lagoon	10/ 128,600	complete sewer system	F.H.A loan approved	Under Construction		
131	Libertyville M-215	0.039	30/15	10/5	complete secondary STP	8/ 75,000	complete sewer system	8/ 395,000	1/	1/	1/
132	Dakota City M- 36	0.042	30/15	11/5	secondary treatment & disinf.	8/ 240,000	none	----	1/	1/	1/
133	Lohrville M-107	0.056	30/15	14/7	upgrade to secondary treatment & disinf.	8/ 210,000	none	----	1/	1/	1/
134	Minburn M-122	C.D.	C.D.	C.D.	third lagoon cell	8/ 85,000	none	----	1/	1/	1/
135	Churdan M-111	C.D.	C.D.	C.D.	third lagoon cell	8/ 90,000	none	----	1/	1/	1/
136	Callender M-112	C.D.	C.D.	C.D.	third lagoon cell	8/ 84,000	none	----	1/	1/	1/
137	Rippey M-119	C.D.	C.D.	C.D.	two lagoon cell	8/ 160,000	none	----	1/	1/	1/

Table VIII-2 (continued)

Rank	Dischargers Ref. #	Waste Load Allocation			Needs				Schedule of Compliance		
		1990 Flow**	Concentration* BOD_5/NH_3	lbs.Eff. BOD_5/NH_3	Treatment	1974 Dollars	Collection	1974 Dollars	Facility Plans	Final Plans	Completion Date
130	Blakesburg M-213	C.D.	C.D.	C.D.	three cell lagoon	128,600[10/]	complete sewer system	F.H.A loan approved	Under Construction		
131	Libertyville M-215	0.039	30/15	10/5	complete secondary STP	75,000[8/]	complete sewer system	395,000[8/]	1/	1/	1/
132	Dakota City M- 36	0.042	30/15	11/5	secondary treatment & disinf.	240,000[8/]	none	----	1/	1/	1/
133	Lohrville M-107	0.056	30/15	14/7	upgrade to secondary treatment & disinf.	210,000[8/]	none	----	1/	1/	1/
134	Minburn M-122	C.D.	C.D.	C.D.	third lagoon cell	85,000[8/]	none	----	1/	1/	1/
135	Churdan M-111	C.D.	C.D.	C.D.	third lagoon cell	90,000[8/]	none	----	1/	1/	1/
136	Callender M-112	C.D.	C.D.	C.D.	third lagoon cell	84,000[8/]	none	----	1/	1/	1/
137	Rippey M-119	C.D.	C.D.	C.D.	two lagoon cell	160,000[8/]	none	----	1/	1/	1/

Table VIII-2 (continued)

Rank	Dischargers Ref. #	Waste Load Allocation			Needs				Schedule of Compliance		
		1990 Flow**	Concentration* BOD_5/NH_3	lbs.Eff. BOD_5/NH_3	Treatment	1974 Dollars	Collection	1974 Dollars	Facility Plans	Final Plans	Completion Date
138	Paton M-115	C.D.	C.D.	C.D.	three cell lagoon	186,000[10]	complete sewer system	252,000[10]	Under Construction		
139	Harcourt M-114	C.D.	C.D.	C.D.	three cell lagoon	97,000[9]	complete sewer system	557,000[9]	1/	1/	1/
140	Jamaica M-118	C.D.	C.D.	C.D.	three cell lagoon	83,000[8]	complete sewer system	330,000[8]	1/	1/	1/
141	Dawson M-120	C.D.	C.D.	C.D.	three cell lagoon	85,000[8]	complete sewer system	350,000[8]	1/	1/	1/
142	Coon Rapids M-134	0.088	30/15	22/11	upgrade to secondary treatment	390,000[10]	lift station force main and sewers	155,000[10]	----	3/1/76	12/1/77
143	Adair M-164	0.076	30/15	19/10	none	----	none	----			
144	Truro M-171	C.D.	C.D.	C.D.	third lagoon cell	79,000[8]	none	----	1/	1/	1/
145	Martensdale M-169	C.D.	C.D.	C.D.	third lagoon cell	86,000[8]	none	----	5/1/77	5/1/78	8/1/79

Table VIII-2 (continued)

Rank	Dischargers Ref. #	Waste Load Allocation			Needs				Schedule of Compliance		
		1990 Flow**	Concentration* BOD_5/NH_3	lbs.Eff. BOD_5/NH_3	Treatment	1974 Dollars	Collection	1974 Dollars	Facility Plans	Final Plans	Completion Date
146	Casey M-165	0.059	30/15	15/7	none	-----	none	----			
147	Lidderdale M-132	C.D.	C.D.	C.D.	third lagoon cell & I/I	91,000 10/	none	----	1/	1/	1/
148	Bayard M-137	0.066	30/15	17/8	complete secondary facility	364,000 10/	complete sewer system	422,000 10/	1/	1/	1/
149	Hartford M-228	.088	30/15	22/11	secondary	183,000 8/	complete sewer system	740,000 8/	1/	1/	1/
150	St. Charles M-172	C.D.	C.D.	C.D.	three cell lagoon	102,000 8/	complete sewer system	470,000 8/	1/	1/	1/
151	Yale M-141	.032	30/15	8/4	complete secondary facility	89,000 8/	complete sewer system	350,000 8/	1/	1/	1/
152	Linden M-139	0.038	30/15	10/5	complete secondary facility	95,000 8/	complete sewer system	390,000 8/	1/	1/	1/
153	Spring Hill M-173	C.D.	C.D.	C.D.	three cell lagoon	83,000 8/	complete sewer system	300,000 8/	1/	1/	1/
154	Patterson M-167	C.D.	C.D.	C.D.	three cell lagoon	74,000 8/	complete sewer system	240,000 8/	1/	1/	1/

Table VIII-2 (continued)

Rank	Dischargers Ref. #	Waste Load Allocation 1990 Flow**	Concentration* BOD_5/NH_3	lbs. Eff. BOD_5/NH_3	Needs Treatment	1974 Dollars	Collection	1974 Dollars	Schedule of Compliance Facility Plans	Final Plans	Completion Date
155	Dexter M-158	C.D.	C.D.	C.D.	third lagoon cell	101,000 8/	none	----	11/1/76	7/1/77	10/1/78
156	Osceola S. M-186-2	1.00	30/15	250/125	upgrade and expand existing treatment plant correct I/I	1,451,200	lift station force main and sewers	NA	Under Construction		1/1/77
157	Urbandale S.D. M- 79	0.875	10/2	73/15	upgrade to advanced I/I	1,090,000 8/	sewers	1,396,000 9/	7/1/76 (I/I)	4/1/77 (Facility Plan)	4/
158	Grimes M- 78	0.131	10/2	11/2	upgrade to advanced	1,200,000 8/	none	----	7/1/76 (I/I)	4/1/77 (Facility Plan)	1/
159	Granger M- 77	C.D. 4/	C.D. 4/	C.D. 4/	third lagoon cell & I/I	142,000 8/	none	----	6/1/76 (I/I)	4/1/77 (Facility Plan)	----
160	Johnston M-224	4/	4/	4/	4/	----	complete sewer system	3,500,000 9/	4/	4/	4/
161	Algona M- 30	0.900	30/6	225/45	complete advanced STP	1,129,000 8/	none	----	10/1/75	7/1/76	7/1/78
162	Armstrong M- 22	C.D.	C.D.	C.D.	third lagoon cell	108,000 8/	none	----	1/	1/	1/

Table VIII-2 (continued)

Rank	Dischargers Ref. #	Waste Load Allocation 1990 Flow**	Concentration* BOD_5/NH_3	lbs.Eff. BOD_5/NH_3	Needs Treatment	1974 Dollars	Collection	1974 Dollars	Schedule of Compliance Facility Plans	Final Plans	Completion Date
163	Swea City M- 23	C.D.	C.D.	C.D.	third lagoon cell	252,000	none	----	1/	1/	1/
164	Ringsted M- 27	C.D.	C.D.	C.D.	third lagoon cell & I/I	9/ 129,000	additional sewer	9/ 18,000	1/	1/	1/
165	Livermore M- 31	C.D.	C.D.	C.D.	third lagoon cell	8/ 84,000	none	----	1/	1/	1/
166	Fenton M- 28	C.D.	C.D.	C.D.	three cell lagoon	9/ 108,000	complete sewer system	9/ 607,000	1/	1/	1/
167	Newell M- 92	0.092	30/2	23/2	upgrade to advanced for NH_3 removal, disinf. & I/I	8/ 130,000	none	----	5/1/76	3/1/77	11/1/78
168	Guthrie Center M-125	0.196	30/15	49/25	upgrade to secondary treatment & disinf.	8/ 24,000	none	----	9/1/76	3/1/77	9/1/78
169	Redfield M-142	C.D.	C.D.	C.D.	third lagoon cell	8/ 108,000	none	----	1/	1/	1/
170	Stuart M-129	0.203	30/10	50/25	upgrade to secondary treatment level I/I & disinf.	9/ 293,000	sewers	9/ 188,000	1/	1/	1/

Table VIII-2 (continued)

Rank	Dischargers Ref. #	Waste Load Allocation			Needs				Schedule of Compliance		
		1990 Flow**	Concentration* BOD_5/NH_3	lbs.Eff. BOD_5/NH_3	Treatment	1974 Dollars	Collection	1974 Dollars	Facility Plans	Final Plans	Completion Date
171	Dedham M-128	C.D.	C.D.	C.D.	third lagoon cell	8/ 82,000	none	----	1/	1/	1/
172	Arcadia M-126	C.D.	C.D.	C.D.	three cell lagoon	10/ 155,900	complete sewer system	10/ 41,200	----	----	1/1/77
173	Halbur M-127	0.026	30/15	7/3	complete secondary treatment	8/ 82,000	complete sewer system	8/ 301,000	1/	1/	1/
174	Woodward M- 75	C.D.	C.D.	C.D.	third lagoon cell	8/ 121,000	none	----	3/1/76	11/1/76	10/1/77
175	Grand Junction M-117	0.040	30/15	10/5	upgrade to secondary, I/I	9/ 153,000	lift station & sewers	9/ 145,000	4/1/77	2/1/78	5/1/79
176	Bouton M- 76	----	----	----	maintain septic tanks	----	none	----	1/	1/	1/
177	Des Moines Area B M-223	4/	4/	4/	4/	4/	upgrade sewer system I/I	10/ 466,000	7/1/76 (I/I)	4/1/77 (Facility Plan)	

Table VIII-2 (continued)

Rank	Dischargers Ref. #	Waste Load Allocation			Needs				Schedule of Compliance		
		1990 Flow**	Concentration* BOD_5/NH_3	lbs.Eff. BOD_5/NH_3	Treatment	1974 Dollars	Collection	1974 Dollars	Facility Plans	Final Plans	Completion Date
178	Greenfield Plaza M-161					Not Eligible		----			
179	Carlisle M-163	C.D. 4/	C.D. 4/	C.D. 4/	4/ I/I	467,000 9/	none	----	4/1/77	4/	4/
180	Norwalk M-159	4/	4/	4/	4/ I/I	409,000 9/	none	----	7/1/76 (I/I)	4/1/77 (Facility Plan)	
181	Menlo M-157	0.041	30/15	10/5	complete secondary facility	160,000 8/	complete sewer system	410,000 8/	1/	1/	1/
182	Cumming M-162	0.029	30/15	7/4	three cell lagoon	87,000 9/	complete sewer system	330,000 9/	1/	1/	1/
183	Indianola S. M-179	0.400	30/15	100/50	upgrade I/I corrections	500,000 10/	new interceptors	738,000 10/	10/1/75	4/1/76	12/1/77
184	Pleasantville M-183	C.D.	C.D.	C.D.	upgrade to secondary treatment	106,000 8/	none	----	1/	1/	1/
185	Milo M-180	C.D.	C.D.	C.D.	third lagoon cell	106,000 8/	none	----	1/	1/	1/
186	New Virginia S.D. M-178	C.D.	C.D.	C.D.	third lagoon cell	88,000 9/	none	----	1/	1/	1/

Table VIII-2 (continued)

Rank	Dischargers Ref. #	Waste Load Allocation			Needs				Schedule of Compliance		
		1990 Flow**	Concentration* BOD_5/NH_3	lbs.Eff. BOD_5/NH_3	Treatment	1974 Dollars	Collection	1974 Dollars	Facility Plans	Final Plans	Completion Date
187	Ackworth M-181	----	----	----	maintain septic tanks	----	none	----	1/	1/	1/
188	Lacona M-189	C.D.	C.D.	C.D.	third lagoon cell	96,000 8/	none	----	1/	1/	1/
189	Lucas M-188	0.026	30/15	7/3	complete secondary STP	84,000 8/	complete sewer system	310,000 8/	1/	1/	1/
190	Williamson M-189	0.023	30/15	6/3	complete secondary system	82,000 8/	complete sewer system	290,000 8/	1/	1/	1/
191	Woodburn M-187	----	----	----	maintain septic tanks	----	none	----	----	----	----
192	Buffalo Center M- 3	C.D.	C.D.	C.D.	third lagoon cell	105,000 8/	none	----	4/1/77	3/1/78	10/1/79
193	Ledyard M- 1	0.024	30/15	6/3	secondary plant	83,000 8/	complete sewer system	300,000 8/	1/	1/	1/
194	Lakota M- 2	0.039	30/15	10/5	secondary plant	107,000 9/	complete sewer system	515,000 9/	1/	1/	1/
195	Rake M- 4	0.033	30/15	8/4	secondary plant	137,400 9/	complete sewer system	162,700 9/	1/	1/	1/

TABLE VIII-3

SUMMARY OF MUNICIPAL TREATMENT NEEDS

Treatment Type Need	Number	1974 Dollars
Complete Advanced STP	15	$103,773,600
Upgrade to Advanced STP	17	7,904,400
Complete Secondary STP	24	7,500,000
Upgrade to Secondary Facility	21	5,705,200
Three Cell Lagoon	30	4,592,100
Add 2 Additional Cells	5	581,000
Add Third Lagoon Cell	50	5,407,000
I/I Correction Only	5	1,682,800
Collection System Needs	83	53,202,400
No Need	8	
Maintain Septic Tanks	35	
TOTAL	293	$190,348,500

Industrial Needs

Iowa has become increasingly more industrialized. Many industries are agriculturally oriented, such as meat packing and processing, dairy and cheese processing, fertilizer and pesticide production, wet grain milling, and rendering. All of these are "wet" industries (using large quantities of water) and produce inordinately large amounts of waste which are difficult to treat by conventional methods. In the Des Moines River Basin most of the industries discharge to municipal treatment facilities. Sometimes they cause an overload condition upon the municipal plant.

Some industries have their own treatment facilities such as Farmland Industries and Iowa Beef Packers at Fort Dodge. Farmland, a fertilizer plant, has a holding pond discharging cooling water contaminated by ammonia nitrogen. Iowa Beef has an anaerobic/aerobic lagoon system which reduces BOD in the system more than ninety percent. The waste load from these industries is still so great that controlled discharges of their effluent must be maintained.

The majority of industry in the basin is "dry" (using little or no water) such as tractor and implement manufacturing, tire manufacturing, metal fabrication (for furnaces and appliances), printing, and electrical component assembly.

The DEQ, through the State Operation Permit Program, in coordination with the Federal NPDES Discharge Permit Program will regulate industrial dischargers. Effluent limits are set according to the waste load allocations. BPT is the minimum allowable allocation.

Table VIII-4 lists the significant industrial discharges in the basin, their present discharge, waste load allocation, projected need, and a compliance schedule. A permit will be issued by the DEQ to the industry, which will assure compliance with the basin plan.

According to the schedules of compliance for the significant industrial dischargers, a reduction of industrial waste loads of 75% and 74% of BOD_5 and ammonia-nitrogen, respectfully, is expected. This reduction is estimated to cost the industries approximately 2.5 million dollars. This cost estimation was derived from a DEQ survey of the significant industries.

Semipublic

The major semipublic wastewater disposal problem is water treatment plants. Many of these plants use lime (calcium hydroxide) to soften the water before distribution. The sludge created poses a significant disposal problem.

Most facilities lagoon the sludge, but this does not answer the final disposal problem of what to do when the lagoons are full. Some plants discharge their lime sludge directly to the river. These plants are currently studying methods to eliminate such discharges.

TABLE VIII-4

TREATMENT NEEDS AND SCHEDULE OF COMPLIANCE FOR SIGNIFICANT INDUSTRIES

Industrial Discharger	Flow MGD	Present Eff. lbs.- BOD/NH_3	7/1/77 Eff. lbs.- BOD/NH_3	Treatment Needs	Schedule of Compliance		
					Preliminary Report	Final Plans	Completion Date
Beaver Valley Canning I-43	0.025	4.2/-	0/0	To Grimes STP	-	-	-
Farmland Industries I-31	0.60	50/88	50/10	NH_3 reduction	3/30/75	7/30/75	7/1/77
Iowa Beef Processors I-25	1.00	1580/900	168/300	BOD_5 & NH_3 reduction	3/30/75	9/30/75	7/1/77
Mefferd Industries I-52	0.007	20*	.002*	New Facility	Not Drafted to Date		
Oscar Mayer I-56	0.90	563/525	282/75	New Treatment Facility	3/1/75	6/1/75	3/31/77
Plains Poultry I-41	0.01	9/-	3/-	Upgrade Exist-	7/1/75	10/1/75	5/31/76

* Values are shown for hexavalent chromium.

Lime sludge does have an economic value if handling problems can be overcome. The sludge can be used for landfill, or as a pH buffer on farmland which has acidic soil. Recently concrete manufacturers have expressed an interest in the material, since it is one of the major ingredients in their product.

As pressure is brought to bear on water treatment plants from Government agencies and landowners located adjacent to sludge lagoons, lime sludge disposal will receive greater attention.

An estimate of semipublic needs and related costs to meet the basin plan has not been performed due to a lack of information detailing the facilities.

Nonpoint Source Needs

Nonpoint sources of pollution have been divided into the three main areas: general rural runoff, animal feeding operations, and urban nonpoint sources. Each of the three areas has been discussed in Chapter VII, and in greater detail in the Supporting Document (3).

General Rural Runoff - The major pollution parameters in general rural runoff have been classified as sediment, nutrients, and organics. Sediment is usually the parameter of most significance.

Nutrients can also be of major significance especially if they will affect near-by lakes or impoundments. Runoff from cropland is a major source of nutrients. Nutrient pollution abatement is accomplished through improved methods of fertilizer application and implementation of the same measures used to control soil loss.

Except where runoff occurs from animal feeding operations, organics are usually of relatively minor importance, especially when compared with the contribution from municipalities.

Physical needs for abating general rural runoff pollution reduce to those methods employed for controlling soil loss. These methods have been discussed in some detail in the Supporting Document (3). An estimate to implement such control measures in the Des Moines basin was presented in Ch. VII. The estimated capital investments amounted to approximately 340 million dollars.

Animal Feeding Operations - The major pollutants from animal feeding operations are suspended solids, nutrients, and organics. Physical needs to control these sources of pollution have been summarized as including debris basins and retention basins, with land application for final disposal. The estimated capital investments to implement such control measures in the Des Moines River Basin amounted to approximately 11.5 million dollars.

Urban Nonpoint Sources - In urbanized areas, surface runoff and combined sewer overflows can adversely affect the utility of the water resource. Contaminants discharged to a watercourse are the result of debris, animal droppings, eroded soils, tire and vehicular exhaust residues, deicing compounds, pesticides, fertilizers, air pollution fallout, and decayed vegetation contained in the urban runoff. The estimated capital investments to implement control measures in the Des Moines River Basin amounted to approximately 767 million dollars.

Summary of Needs

The total dollar need to meet the objectives of this basin plan for the Des Moines River Basin is estimated to exceed 1.3 billion dollars. This amount is broken down in Table VIII-5.

TABLE VIII-5

SUMMARY OF NEEDS

Need	Approximate Dollars*
Municipal Treatment	$137,146,100
Municipal Collection and Combined Sewer Overflow Correction	53,202,400
Industrial Treatment (Significant Industries)	4,500,000
Animal Feeding Operations Controls	11,551,000
Soil Loss Controls	338,998,000
Urban Stormwater Treatment and/or Control Costs	767,300,000
TOTAL	$1,312,697,500

* 1974 Dollars

REFERENCES

1. Sewage Treatment Plant and Sewer Construction Cost Index, U.S. EPA Office of Water Program Operations, Municipal Construction Division.

2. Manson, R.J. and Merrit, C.A., "Land Application of Liquid Municipal Wastewater Sludges", Water Pollution Control Federation Journal, Vol. 47, No. 1, January, 1975.

3. Supporting Document For Iowa Water Quality Management Plans, Iowa Department of Environmental Quality, Water Quality Management Division, Des Moines, Iowa, 1976.

CHAPTER IX - CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

Several significant conclusions have arisen throughout the development of this basin plan. Some of these include:

1. The Des Moines River Basin currently has 217 incorporated municipalities with a total population of 731,092. The population of these municipalities is projected to increase by 8 percent to 790,316 by 1990.
2. Of the 217 incorporated municipalities, 136 currently have collection and treatment facilities and 86 communities have no central sewage systems. Many of the treatment facilities are not presently achieving secondary treatment.
3. Waste stabilization lagoons serve nearly 50 percent of the municipalities and a large number of industries within the basin.
4. A number of water quality violations have been documented in the basin due to point source discharges. Most of these violations have occurred at stream flows well above the 7-day 1-in-10 year low flow.
5. Water Quality violations have been documented during high stream flows. These pollution problems can probably be attributed to agricultural and urban runoff.
6. Sediment, which often carries other pollutants with it, is a significant pollution parameter in Iowa. Proper land and water management can minimize soil erosion.

Effort should be made to continue and increase the use of established soil conservation practices. Pesticides in the environment can be reduced by using soil conservation practices and fertilizer loss can be minimized by application methods which assure efficient uptake by crops.

7. All lakes and reservoirs in the basin are subject to potential eutrophication from rural and urban runoff.
8. Land disposal of digested municipal sewage sludge is the most economical ultimate disposal method currently being used in the planning area.
9. Waste load allocations have shown that a significant number of dischargers will be required to provide advanced waste treatment to meet water quality standards at the 7-day, 1-in-10 year low streamflow. This is particularly true in the Upper Des Moines River and Raccoon River Subbasins.
10. The water quality strategy for point sources, as outlined in the plan, should result in the maintenance of acceptable surface water quality for designated uses.
11. The Des Moines River Basin Plan has demonstrated (Chapter VIII) a need for municipal treatment and collection facilities which may exceed a cost of 190 million dollars.

12. Most industries should be able to meet the July 1, 1977 requirements of the Act. A high percentage of municipalities will also meet this deadline, however, long construction schedules and lack of adequate grant funding will result in some municipalities not meeting the deadline. The 1983 goals requiring all streams to be of suitable water quality to be fishable and swimmable can be met if Federal funding is continued.

RECOMMENDATIONS

As stated in the Foreword, the objective of this Basin plan is to provide the framework for achieving the protection and maintenance of surface and ground water quality in the Des Moines River Basin. The implementation of this Basin plan will help in attaining that objective, however, several possibilities exist that would further aid this effort. It is therefore recommended that the following topics be given further consideration and study.

1. The State Water Plan, which is currently under development, should give careful consideration to water quality. Consideration should also be given to restricting future water uses in water quality limited segments.

2. Non-structural management measures that can enhance and protect water quality should be given careful consideration by all levels of government, business interests and private citizens.

   Examples include:

   a. Improved operation should be initiated at all waste treatment systems. Small communities may be able to accomplish this goal by sharing qualified operators and laboratory facilities.
   b. Land use planning and zoning decisions should include considerations of water quality. This is particularly important when development around lakes may occur.

c. Local government should give consideration to the impact on water quality before making commitments for new development or industry.

d. Tillage practices should be selected that will minimize soil erosion.

e. Woodland management practices should be selected that will minimize soil erosion.

f. Agricultural chemicals should be applied at rates and times that will minimize runoff fertilizers and herbicides.

g. The design of any new or expanded industrial or commercial facilities should give careful consideration to minimize the amount of waste products that will be discharged from that facility.

h. Recycling should be encouraged and selected even when marginally cost-effective on the assumption that the cost of all natural resources will increase in the future.

i. Strict enforcement of local ordinances should be practiced. Such ordinances should include provision for rigid inspection of all new sewer construction and connections.

j. County Boards of Health should adopt and enforce individual waste disposal system regulations promulgated by the State Health Department.

k. Sanitary districts should be established to provide sewerage services to unincorporated areas.

l. Although thermal discharges are not considered to be a major problem in the study area, they are significant enough that further studies are warranted to determine specific thermal limits.

m. Land disposal of wastewater should be considered where soil and other conditions permit, and complete retention lagoons rather than small mechanical treatment plants should be considered, where applicable, in view of the national goal of zero discharge of pollutants by 1985. The communities, assisted by the Department of Environmental Quality, are responsible for considering this in their plan alternatives.

n. It is known that urban runoff contains metals and other pollutants, but their impact on downstream water uses needs further studies. Urban runoff can be controlled by storage and treatment. Economic feasibility studies should be performed for all major municipalities.

o. Land disposal of digested municipal sewage sludge is the most economical ultimate disposal method presently used. Many communities let sludge drying facilities lie idle much of the time, preferring to wet haul sludge when farmland is available and ready for receipt of the sludge. Departmental policy should address the disposal of municipal sludge. An educational program might be worthwile to emphasize the economic advantages of using sludge as a soil conditioner and fertilizer supplement.

p. Establishment of specific waste load allocations has indicated certain areas where regionalization of facilities should be considered. In addition to combining industrial discharges with publicly-owned facilities, combinations of municipal facilities are possible.

(1) Facility Planning - It is recommended that detailed evaluations should be performed as an element of the Section 201, Step 1 Facilities Planning for regionalization of waste treatment facilities in the following areas:

Estherville Area - Estherville, Morrell and Co., and Wadco Foods, Inc.

Pocahontas - Pocahontas and Iowa Industrial Hydraulics, Inc.

Fenton Area - Fenton and Central Community School District

Humboldt Area - Humboldt and Dakota City

Lehigh Area - Lehigh, Dayton, and Dickey Clay Mfg.

Webster City Area - Webster City and Franklin Mfg.

Fort Dodge Area - Fort Dodge, Farmland Industries, Hormel and Co., Fort Dodge Creamery, American Can Processors, Land O'Lakes, Webster Processing Co. and Savage Sanitary Sewer District

Storm Lake Area - Storm Lake, Vilas, Hygrade, Lakeside

Perry Area - Perry, Oscar Mayer

Pella Area

Oskaloosa Area

Ottumwa Area

(2) Areawide Planning - The Des Moines Metropolitan area has already been officially designated by the Governor as a 208 areawide planning area. The planning agency for the area is the Central Iowa Regional Association of Local Governments (CIRALG). No other 208 designation are currently recommended for the Des Moines Basin.

(3) Other - At the community and county level zoning and land use planning should be used to assure an orderly and efficient development of unsewered areas.

3. Structural measures will of course also help to protect water quality. Many of the structural measures required in the basin are outlined in the needs table.

CHAPTER X - REVIEW AND REVISION

PUBLIC HEARING PROCEDURE

Public hearings are specified by the Federal Water Pollution Control Act Amendments of 1972 as part of the procedure for establishing a water quality management plan for river basins. In accordance with Section 101(e) of the Act, public participation was required on significant elements of the planning process.

Statements or presentations given at public hearings were required to be retained in writing for the record. Verbal comments and written statements were specified to be limited to the Water Quality Management Plan. Written statements were requested to be submitted to DEQ at least one week prior to the hearing. Additional statements, filed within ten days after the scheduled hearing, were also considered part of the record.

"Reasonable Notice" was given to the public by prominent advertisement, indicating time, date, place, and availability of proposed plan, 30 days prior to the date of each hearing. Complete records of such hearings are kept and a transcript made available on payment of fee.

WATER QUALITY STANDARDS REVIEW

The Federal Act specifies that at least every three years, starting from date of enactment of the 1972 Amendments, the Iowa Water Quality Commission hold public hearings for purpose of review, and/or revision, of the Iowa Water Quality Standards. The 303(e) process, including this basin plan developed as part of the process, is used to assist in making any necessary revisions of Iowa Water Quality Standards. The Iowa Water Quality Standards are scheduled for revision in 1976.

BASIN PLAN REVISION

This Basin Plan is Phase I of the annual continuing planning process as required by section 303(3) of the Act. This basin plan will be revised under Phase II in such manner as is necessary to maintain its viability. Thereafter, this Basin Plan will be reviewed annually and revision will be made if warranted. Revision to the wasteload allocations, compliance schedules, or construction grant needs and priorities will be based on the most current and accurate data available.

BASIN PLAN HEARINGS

Three public hearings concerning the adoption of the proposed Des Moines River Basin Water Quality Management Plan were conducted by the Department of Environmental Quality. The hearings were held October 21, 1975, at 10:00 a.m. at the Humboldt Social Center, 702 First Ave. N., Humboldt, Iowa; October 22, 1975, at 7:30 p.m. at the Des Moines Area Community College Auditorium, Building 24, Ankeny, Iowa; and October 23, 1975, at 7:30 p.m. at the Indian Hills Community College Auditorium, Administration Building, Ninth and College (Ottumwa Airport), Ottumwa, Iowa. A copy of the public notice announcing the hearings appears in this chapter.

Identified in the following list are persons who attended the hearings:

At Humboldt

Name	Representing
Ivan T. Schultz	Self
Paul Silbaugh	Humboldt Co. Conservation Board
Asu S. Arent, MD	Self
Carry Steburg	City of Fort Dodge
Dennis Plautz	City of Fort Dodge
Steve Hakeman	Humboldt Newspapers
E. A. Tellier	Self
Milton R. Berger	Humboldt Co. Conservation
Myles Van Patter	Self
Wm. Ellingrod	Palo Alto County
John T. Baker	SCS
Maurice A. Marble	Ia.-Ill. Gas & Electric
Tim Duritsa	Ft. Dodge Chamber of Commerce
Ray Schlotfeldt	Schlotfeldt Engineering
William H. Heilman	Schlotfeldt Engineering
Stan Logterman	Hormel
Dan C. Adams	Corn Belt Power Coop
Arlin Schalekamp	ICC
Steve Schutte	ICC

At Ankeny

Name	Representing
Susan Barisas	INRC
E. R. Baumann, Prof.	ISU
Jeffrey Dezellar	Minnesota Poll. Control Agency
Dale S. Harrington	CIRALG
Merwin D. Dougal, Prof	WRRI, ISU
Dick Jacobson	City of Ankeny
Mrs. Wm. Mills	Self
Gary F. Elbert	Indianola
Max Schnepf	Journal of Soil & Water Cons.
William A. Mills	SCS
Harold Coder, Mayor	City of Coon Rapids
Bob Gee	INRC
R. G. Glenn	Veenstra & Kimm
D. Beason	CIRALG
Paul D. Schreck	Mun. Utilities, Coon Rapids
L. J. Lemprecht	Mun. Utilities, Coon Rapids
Arnold R. Lamp	City of Coon Rapids
Ray Henely	AGC of Iowa
Ron Jackson	Kirkham, Michael & Assoc.
Gary Speiran	Self
Victor Ziegler	EPA
James G. Armstrong	U.S. Fish & Wildlife Service
Michael D. Foreman	CIRALG
Robert G. Page	Iowa Power & Light
Leroy Bergmann	Shive-Hattery & Assoc.
Ronald L. Cooper	Oakes Eng. Co.
Martin H. Meyer	INRC
Marvin Thorton	Veenstra & Kimm
Roger A. Wood	Indianola

At Ottumwa

Name	Representing
Ann Morris	League of Women Voters
Fred Van Glenderen	Self
C. B. Curtis	Water Quality Commission
Victor Ziegler	EPA

iowa department of environmental quality

NOTICE OF PUBLIC HEARING

The Iowa Department of Environmental Quality (DEQ) will hold public hearings concerning the adoption of the proposed Water Quality Management Plan for the Des Moines River Basin on October 21, 1975, at 10:00 a.m., at the Humboldt Social Center, 702 1st Ave. N., Humboldt, Iowa; on October 22, 1975, at 7:30 p.m., at Des Moines Area College Auditorium, Building No. 24, Ankeny, Iowa; and on October 23, 1975, at 7:30 p.m., at the Indian Hills Community College, 2nd floor, Administration Building, 9th & College (Ottumwa Airport), Ottumwa, Iowa.

The Water Quality Management Plan is specifically directed toward satisfying the requirements of Section 303(e) of the Federal Water Pollution Control Act, as amended, Public Law 92-500, 86 Statute 849 (1972); (33 United States Code Annotated 1313(e)). The purpose of the Water Quality Management Plan is to identify the water quality problems of the Des Moines River Basin and to set forth a program to correct the problems.

The public hearings (held pursuant to Subsection 455B.32(7) of the Code of Iowa and 40 Code of Federal Regulation Part 131.502 (Federal Register, Volume 39, 19643, June 3, 1974)) will give the public opportunities for expression of views to DEQ as well as provide for total public disclosure of the Water Quality Management Plan.

Oral and written statements presented at the hearings will be retained in the written record of the hearings. Statements should be limited to the subject matter of the Water Quality Management Plan for the Des Moines River Basin. Time limits may be set on oral presentations at the discretion of the hearing officer so that all those wishing to speak may be heard. Written statements may be submitted to DEQ prior to the hearings and at any of the hearings. Written statements received within ten days after the third hearing will also be considered part of the hearings record. Complete records of the hearings will be kept and transcripts will be available upon payment of a duplication fee. The final Water Quality Management Plan will include a description of any major objections raised during the period for public comment and the disposition of such objections. The plan will become effective after approval by the Iowa Water Quality Commission, the Governor of Iowa and the U.S. Environmental Protection Agency.

A copy of the proposed plan will be available for inspection in the City Clerk's Office in the county seat of each county located in, or partially in, the Des Moines River Basin. Copies will also be available for inspection in the DEQ regional offices located in Manchester, Mason City, Spencer, Washington and Council Bluffs, and in the main office in Des Moines. Written statements and requests for additional information should be addressed to the Water Quality Management Division, Iowa Department of Environmental Quality, 3920 Delaware, P.O. Box 3326, Des Moines, Iowa 50316, telephone: 515/265-8134.

WATER QUALITY MANAGEMENT DIVISION

Joseph E. Obr, P.E., Director

3920 Delaware Ave., P.O. Box 3326, Des Moines, Iowa 50316 • 515/265-8134

The substantive comments (both written and oral) for all six basin plans presented at the hearings and/or directly submitted to the DEQ office in Des Moines, have been compiled. Responses made by the DEQ staff were then presented to the Iowa Water Quality Commission. Those commenting on the plan included federal and state agencies, county and local governments and agencies, industrial organizations, local citizens and special interest groups. Many of these comments have been adopted or substantially justified by change, deletion from, or additions to the basin plans. The Commission approved the plans and copies along with the comments and responses were sent to the Region VII office for EPA's approval. Oral and written statements presented at the hearings are available at the DEQ office for inspection. Copies may be obtained from the DEQ for a reproduction fee.

The DEQ has revised the plans in responses to issues raised, which could be resolved easily and not slow the progress of the study. If, however, it cannot readily be resolved and is a major issue, the issue will be addressed in Phase II of the planning process.

The water quality standards and the stream classifications will be reviewed in 1976. The DEQ, in cooperation with the Iowa Conservation Commission, will evaluate stream use and classification. The chemical and physical parameters listed in the standards will also be subject to review. Public hearings will be held prior to commission approval.

The stream segment and discharger ranking methodology, as required by Sec. 303(e) of the Act, may be the basis for future construction grant funding. Before any future grant priority list is compiled, which may be based on new priority formulas, the methodology will be reviewed and public hearings held. The discharger ranking used in the basin plans basically assumes that dischargers creating the greatest impact on water quality will be addressed more quickly than dischargers with less impact. This methodology will be expanded before it is used for the construction grant ranking.

New data regarding the seven-day ten-year low flow is now available and new population projections are expected. This will necessitate updating many waste load allocations in the Phase II planning program.

As stated earlier, 303(e) basin planning, or Phase I, mainly addressed point source pollution abatement. Under EPA (Phase II) guidelines, states are required to fully address nonpoint source pollution and to develop abatement programs to handle the problem. Phase II planning will continue to include point source waste load allocations and time schedules, and will update the municipal needs tables. Much of this will concern locating errors, or be tied to stream reclassification, new low flow data or standards revision.

The goal of Phase II planning is to reassess controls and needs of combined sewer replacement, feedlot control, urban runoff, and rural nonpoint pollution and to assign implementation programs.

GLOSSARY

Activated sludge is a completely aerobic treatment process by which wastewater is fed continuously into an aerated tank where microorganisms metabolize the organic material. The biological floc is settled in a final clarifier and may be recirculated to the aeration basin. Ninety to ninety-five percent BOD removal can be achieved.

Aerobic denotes biological processes in which oxygen is used for the decomposition of organic matter.

Anaerobic denotes biological processes in which decomposition of organic matter is accomplished in an environment devoid of free oxygen.

Biochemical oxygen demand (BOD) is the quantity of oxygen utilized in the biochemical oxidation of organic matter in a specified time and at a specified temperature.

Combined sewer is designed to carry sanitary sewage, industrial wastes, and storm runoff in a single conduit.

Disinfection of water or wastewater is a method of reducing pathogens or objectionable microorganisms by means of chemicals or other acceptable means.

Dissolved oxygen is the concentration of oxygen dissolved in a liquid. If affects biological changes brought about by aerobic or anaerobic organisms, and is an important environmental factor for growth and reproduction of fish and other aquatic organisms. Determination of dissolved oxygen also serves as the basis of the BOD test.

Gaging station is a particular site on a stream, canal, lake, or reservoir where systematic observations of gage height or discharge are obtained.

Holding or storage pit is a covered container into which wastewater flows until it can be pumped out and taken to a treatment facility.

Industrial wastewater is the wastewater which originates in industrial processing, cooling, or washing operations.

Infiltration is the groundwater which gains entrance to sewers through joints or improper connections.

Intermediate treatment involves additional settling of the wastewater and may incorporate chemicals to aid the settling process. Normally 50 percent BOD removal may be obtained through this process.

Intermittent stream is a stream with 7-day, 10-year low flow less than 0.1 cubic feet per second.

Lagoon or stabilization pond is generally a shallow geometrical pond which treats pretreated or untreated sewage biologically. Wastewater is retained in the pond for treatment and a clarified effluent is discharged after a specific detention time.

Main sewer is a conduit to which one or more branch sewers are tributary.

Outfall sewer receives the wastewater from a collection system and carries it to a point of final discharge.

pH is the negative logarithm of the hydrogen ion concentration. A pH below 7 indicates an acid condition and a pH above 7 indicates an alkaline condition.

Population equivalent measures the strength of a wastewater in terms of an equivalent number of persons, using an average 0.17 pounds of oxygen demand per person per day in domestic wastewater.

Pretreatment of industrial waste refers to treatment, usually primary, given to the wastewater before it is discharged into a sanitary sewer for secondary treatment.

Primary treatment involves only screening and physical settling of the wastewater. Approximately 30 percent of the BOD can be removed through this process.

Sampling station is a particular site on a stream, lake, canal, or reservoir where systematic samples of water are taken for analysis for physical, chemical, or biological parameters.

Sanitary sewer is a conduit designed to carry sanitary sewage. However, in many cases, it will also carry industrial wastes produced in the area it serves.

Secondary treatment conventionally involves biological treatment of wastewater to reduce the BOD by 85 percent or more. These biological processes usually involve trickling filters, stabilization ponds, or activated sludge processes. Recently, straight physical-chemical processes have been considered secondary treatment on the basis of their BOD removal efficiency.

Septic tank allows solids to settle out of a waste and permits a clarified effluent to be discharged to a ground seepage system. The solids are broken down anaerobically, and the residue must be pumped out periodically.

Sewage disposal applies to the act of disposing of sewage by any method. It may be done with or without any previous treatment of the wastewater.

Sewage treatment refers to any artificial process to which wastewater is subjected in order to remove or alter its objectionable constituents so as to render it less dangerous or offensive.

Sewage treatment plant is a comprehensive term encompassing an arrangement of devices and structures for treating domestic and industrial wastewater and sludge.

Sewerage is a system of sewers and appurtenances for the collection, transportation, pumping, and treatment of domestic and industrial wastewaters.

Solids are all matter except water contained in a liquid. They may be suspended or dissolved solids.

Storm runoff is the wastewater flowing due to rain water, snowmelt, or other surface runoff.

Storm sewer carries storm runoff and similar waters not including sanitary or industrial sewage.

Trickling filter systems consist of a bed of crushed rock, or other media, coated with biological films, through which primary effluent is passed for secondary treatment. The filter may be followed by a final settling basin, and recirculation through the filter may be employed for better removal. Up to 90 percent BOD removal can be achieved through trickling filter systems in ideal situations.